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A.I.D., AGROFORESTRY AND ITS POTENTIAL  
IN SUB-SAHARAN AFRICA

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Community-Based Tree-Planting and  
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PREFACE

This paper was prepared at the request of the organizers of a seminar on Community-Based Tree Planting and Agroforestry Programs in Sub-Saharan Africa, sponsored by Interaction and A.I.D. on September 16, 1986. The particular assignment was to describe A.I.D.'s view of the forestry problem in Sub-Saharan experience with past programs and its planned commitments for the future. Other papers will deal with the PVO community and view of the problem, their experience and their future.

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SUMMARY AND ABSTRACT

A.I.D. and PVO/NGO experience with tree planting in Africa had its beginnings almost three decades ago when the necessary reconstruction after the North African civil wars leading to independence called for large deliveries of food to help in rehabilitation of returned soldiers and resettlement of the communities dislodged by war.

However, most of this activity took place in North Africa, in part because of the timing of the end of the civil wars, and in part because access from the Mediterranean and coast to sea deliveries much more accessible. In any case, the U.S., private voluntary agency and surplus agricultural food contributions began their services in North Africa rather than in the south, and the services were at the time at quite substantial levels.

For example, in Algeria, Church World Service and the World Food Program, using U.S. surplus food grain supplies, launched a major tree planting effort as a means of providing employment for demobilized soldiers as the laborers. Begun in the mid 1950's, the Algerian program resulted in the reclamation of 200,000 hectares of bare and eroded slopes of the south side of the Atlas mountains. By 1980, the annual planting had increased to more than 50,000 hectares a year.

By contrast, A.I.D. planting efforts in Sub-Saharan Africa did not begin in earnest until the devastating effects of the drought of the late 1960's became obvious. For a number of reasons, progress in the Sub-Saharan region was by no means as spectacular as in North Africa. Early concentration on large scale government-donor managed plantations were not cost effective as a result of poor management, labor shortage, inadequate pre-project planning to match soil and water capability with the choice of tree species chosen and other factors. Nor were A.I.D.'s subsequent shifts to community tree planting any more successful.

It is only recently that, as the Peace Corps, Private Voluntary Agencies and other non-governmental agencies became involved, agroforestry and small scale reforestation and natural resource management efforts began to demonstrate quite remarkably successful results.

Meanwhile, A.I.D.'s policies and future program commitments have been undergoing significant changes that show hope for a shift in emphasis resulting in more rapid growth in revegetation and reforestation. The particular shift that shows the most potential is in the integration of tree and crop planting in ways that can substantially increase the productivity of food and fodder crops through the interaction of water conservation capabilities of bunding, using trees, as well as the contribution of nitrogen from leguminous trees.

In Sub-Saharan Africa, food production per capita decreased by 20 percent during the last two decades. Yet, modest but quite well documented local projects in Sub-Saharan Africa in the recent past have shown that it is possible by the application of only two variables -- bunding for water conservation and improved local food crop varieties -- to produce an increase of 70 percent in production of food crops within two or three years.

The projects on which such potentials can be projected were admittedly small scale and involved usually private voluntary agency participation which encouraged and increased local participation. This suggests that to be successful any national campaign that could rapidly increase food production would need to begin with the use of and enlistment of local non-governmental groups which could be expected to expand as results demonstrated success.

In any event, past experience and A.I.D.'s current commitments to future policy changes suggest that, contrary to current assumptions, the greening of Africa could in fact be possible.

TABLE OF CONTENTS

	<u>Page</u>
Preface	i
Summary and Abstract	ii
I. AID'S VIEW OF THE FORESTRY PROBLEM IN SUB-SAHARAN AFRICA	1
Immediately after independence	
After the drought of 1968-1979	
AID's shift to include village tree planting	
II. AID'S EXPERIENCE WITH PAST PROGRAMS	3
Volume of aid	
Ad hoc nature of aid program	
Evaluation of AID's program	
III. PHENOMENON OF INFORMAL TREE PLANTING ACTIVITIES	5
Large volume of informal tree planting	
Needs more attention because of potential for expansion	
IV. OVERLAPPING NGO/PVO/PEACE CORPS ACTIVITIES	7
Proportionate share	
Peace Corps PASA training opportunities	
Exponential increase in PVO's activities in forestry	
The Tree Project	
V. AID'S PLANNED CONTRIBUTIONS FOR THE FUTURE	9
Integration of trees and agriculture so agroforestry is a reality	
-- AID's Blueprint	
-- Plan for Agricultural Research	
-- CDSS's and Policy Dialogue	
Longer term commitment to forestry involvement	
-- Peace Corps Food Security Initiative with Forestry Component -- 10-year commitment	
-- PVO Partnership Grants will be five years rather than three years	
-- Technology Research, Development and Transfer	
VI. THE GREENING OF AFRICA IS POSSIBLE	13

## OVERVIEW PRESENTATION

### I. AID'S VIEW OF THE FORESTRY PROBLEM IN SUB-SAHARAN AFRICA

#### -- Immediately after independence

Immediately after independence, AID and its donor allies took the view that reforestation in Africa could be handled basically the way industrial reforestation had been managed during the colonial period:

Plant trees in large blocks, harvest them, ship them out for export, pulp or for lumber, replant new blocks; and as fuelwood became scarce, use the same technique for setting up fuelwood plantations.

Organize a crew of foresters whose main tasks were to plant, cultivate and harvest trees and to protect the plantations from herders and their camels and goats and the farmers whose increasing demand for agricultural land encroached on crown lands reserved for the State or private industrial tree plantations.

#### -- After the 1970 drought

Once the drought of the 70's struck, it became clear that this approach could not solve the fuelwood shortage.

African governments did not have funds to pay for and maintain a corps of foresters sufficient even to protect existing crown lands and plantations.

Population expanded rapidly as civil wars ended and donor relief and rehabilitation helped reduce death rates.

Most importantly, the oil embargo and sharply accelerating oil prices wiped out the usual source of fuel for poor agricultural communities -- kerosene. In addition to clearing woodlands and brush to provide additional, although marginal, agricultural lands, the peasants stripped the land of wood for firewood and fodder, as well as for poles for building. Urbanization accelerated this process and deforestation took place at a rate so fast it was scarcely noticed by those who needed to plant for food and fuel for farms and city needs.

-- AID's snift to include village tree planting

Although for the most part other donors continued with heavy empnasis on large scale fuelwood plantations, beginning in about 1974 AID snifted its emphasis to small scale community wood lots, on the grounds that villages are likely to take care of themselves and their trees for their own benefit, an assumption that proved unstable.

## II. AID'S EXPERIENCE WITH PAST PROGRAMS

### -- Volume of AID

As a result of the drought, AID became engaged in natural resources/forestry/environment projects in Sub-Saharan Africa on a fairly significant scale over the past decade, at levels averaging about \$ 25 million a year. The life-of-project portfolio was about \$60 million in forestry and fuelwood projects, and another \$80 million in closely related natural resources and renewable energy projects, involving some 50 projects in 26 countries. To this should be added about \$125 million in similar PL 480 supported activities carried out over the same period.

### -- Ad hoc nature of aid program

This portfolio was, however, essentially ad hoc, a collection of short term, individually designed and initiated projects rarely related, if at all, to the USAID's longer range country development assistance strategies.

Few project activities were authorized for more than three years, although most programs included in the Country Development Strategy Statements (CDSS's) were intended to cover periods of at least five years. The USAID directors authorized to draft the strategies and responsible for their implementation often served terms of only two years. Consequently, although the overall volume of natural resources activities supported by AID has been quantitatively quite impressive and the strategies described in the CDSS's sound cohesive and comprehensive, in fact their impact, individually within each country and more generally within Africa as a whole, has been minimal.

### -- Evaluation of AID's Program

During 1983 and 1984, the Africa Bureau undertook a major evaluation of its experience with these projects and concluded, as had other donors during the same period, that the early emphasis on individual projectized activities, particularly on large scale fuelwood plantations and on communal village woodlots -- where most of the funding was directed -- was not

cost-effective. More important, this emphasis did not really address the major problem, namely the overuse of the land by farmers and herders that was leading to vegetative degradation and deforestation, which was a primary cause of declining per hectare and per capita food grain yields. In addition, the quality of tree and food seed and seedling stock provided was, in the words of a seasoned technician, "genetic garbage".

### III. PHENOMENON OF INFORMAL TREE PLANTING ACTIVITIES

#### -- Large volume of informal tree planting occurring

Concurrently several countrywide studies (for example, in Kenya, Malawi, Senegal and parts of Nigeria) revealed that a very large amount of private on-farm small scale land conservation and tree planting was taking place, without any significant external donor or African government aid.

For example, thirty mature neem trees on farms about two hectares in size in Northern Nigeria, regularly heavily pruned, are claimed to be able to supply all of an average rural family's fuelwood needs over 15 years. As few as 100 to 150 gmelina, leucaena or Acacia albida used as farm trees interplanted in fields or as windbreaks or along farm boundaries can supply half or more of a rural family's needs in arid or semi-arid regions.

Farmers in Senegal, Kenya and Malawi have been adopting these planting configurations in recent years. About ten percent of smallholders in Malawi report having planted 100 or more trees over the five past years. A much larger proportion of fuelwood supply appears already to be obtained from on-farm trees or woodlots than has up to now been assumed. A 1983 analysis of Kenya's fuelwood supply and demand reported that 45 percent of current fuelwood production comes from on-farm forestry. About 25 percent comes from the natural woodlands -- the open "commons" -- and the remainder is harvested from gazetted forests and plantations. A 1981 study of fuelwood yields and production in and around Kano, Nigeria, reported 70% of fuelwood supplies were from trees on farmland, 24% came from fallow lands and 6% from forest reserves. Household requirements can be modest because total usable biomass yields per tree from widely spaced farm trees, over their lifetimes of 30-50 years, can be double or quadruple those from the same number of trees grown in closely spaced block plantations. They can be regularly and severely pruned, annually or biennially, and the harvested twigs and branches can be used (or sold) for poles and fuelwood, while the trees continue to grow.

In addition to the fuelwood and fodder supplies that can be obtained, the soil can be simultaneously improved by the addition of organic matter from the leaves and droppings, and a net increase in water availability can be achieved when the trees are planted in bunding configurations.

-- This practice needs more attention because of potential for expansion

These natural resources improvements are being achieved despite the fact that little technical assistance was being provided to improve yields and survival rates or to providing tree species of the kind desired by farmers.

This anomaly deserves more attention, because it represents a major private, small holder initiative which could be expanded to the larger scale needed for the countrywide national resources management and tree planting campaign currently being considered by several African countries.

IV. OVERLAPPING NGO/PVO/PEACE CORPS ACTIVITIES

-- Proportionate Share

NGO/PVO organizations have been to a considerable degree responsible for these achievements. About 24 percent of current LOP AID financed/forestry projects obligations - about \$21 million - are being channeled through these organizations. The Peace Corps and PVO's are increasingly bridging the gap between the peasantry and African government forest service personnel, up to now traditionally seen as policemen.

-- Peace Corps PASA training opportunities

AID's worldwide Peace Corps PASA (\$1.4 million, 1982 to 1985), was instrumental in increasing the number of Peace Corps forestry trained volunteers assigned to Africa from about 20 in 1982, to 152 in 1985, assigned to 21 countries. Additionally, this PASA has financed a forestry technical assistance training manual specifically designed for Africa, as well as two within-Africa regional training programs which included host country African counterparts as well as other associated PVO's working in the area. The PASA has been renewed, at an estimated cost of \$2.3 million financed under the PPC account, for four years. It will provide up to six training workshops, including one regional workshop already scheduled for Kenya. In preparing the forestry/environment strategy, it will be possible to explore whether AID should begin now to work with the Peace Corps to encourage location of additional PC managed workshops in several more of the priority countries identified in the Plan for African Agricultural Research, so that PVO tree planting activities can have the benefit of continuing in-country training and extension assistance.

-- Exponential increase in PVO activities in forestry

In recent years, assisted by FVA/PVA matching grants and local currency from PL 480 programs, PVO's in Africa have expanded their local rural agro-forestry programs at an almost exponential rate. When combined with AID's

sources, including private U.S. donations, the scale is impressive. For example, CARE alone has forestry and agro-forestry projects under way in the following countries: Cameroon, Chad, Mali, Niger (three projects), Uganda, Sudan (two), Somalia (two), Comoros, Rwanda, Kenya, and Lesotho. New projects are planned for Chad, Ethiopia and additional activities in Somalia and Sudan. CARE has regional assistance teams in forestry, based in East and West Africa. It has also joined a formal network of NGO's working in forestry, established by the UNDP's non-governmental organizations' liaison office, one of whose activities is the Tree Project.

#### The Tree Project

The Tree Project, within the framework of the United Nations' International Tree Project Clearing House, has already carried out an in-country PVO coordinating workshop in Senegal, where the equivalent of some 5,000 hectares of trees had been planted by 33 Senegalese and foreign PVO's in 1984 alone, as compared with 4,000 hectares planted by nationally sponsored projects. The workshop developed a number of follow-on action programs which could provide technical assistance support and in-country coordination models for other African countries. In the course of developing a forestry and environment strategy, the results and lessons learned from this process should be reviewed to determine whether and how additional private funding could be channelled for similar workshops in other countries.

V. AID'S PLANNED CONTRIBUTIONS FOR THE FUTURE

On the basis of these project and program evaluations and findings, AID -- in cooperation with other major donors -- has now begun the process, slower and more difficult, of reorienting its resources in the direction of both basic and applied research to improve the yields, drought resistance and nitrogen fixing capabilities of tree species and related contour planting and water catchment techniques, particularly as they can improve soils and conserve rainfall on African agricultural lands. In addition, AID is beginning to enlist other donors in policy dialogue in a few countries that could improve the political and social conditions under which which farmers will feel more confident that their own efforts in growing trees on their own land will result in benefits on which they can draw without being penalized, as is often the case in many African countries now.

Integration of trees and agriculture so agroforestry becomes a reality in AID's programs

There is now a formal confirmation of the link between natural resources rehabilitation, including the primary role tree planting can play in such rehabilitation, and improved agricultural production. Although this link may seem obvious to conservationists it is not and has not been obvious to agricultural research experts. The following AID policy papers and decisions formally confirm the importance of natural resources rehabilitation and agroforestry to meet the Agency's agricultural production goals.

- o AID's Blueprint for Development, approved and issued in mid-1985 explicitly recognizes and articulates the need to halt and reverse environmental degradation in order to increase both agricultural production and overall gross national product. (pp. 33-34, 68, 74-75) "Concern for increasing agricultural production as an element of self-sustaining economic development requires concern for the basic raw material of farmers -- the land itself. Environmental degradation, aggravated by overuse of marginal lands, deforestation, salinization and erosion, can overtake progress and leave a nation poorer in resources than when development began." (33-34)

- o The Plan for Agricultural Research in Africa approved in May of 1985, specifically identifies agro-forestry research as an essential element in the overall, long range effort to increase agricultural production. (pp. 12-13, 20)
- o Including agroforestry in CDSS's and Policy Dialogue

AID programming strategy delegates to USAID Mission directors the authority and responsibility for identifying priority development sectors within which the already scarce country program resources can and should be concentrated. During the current round of Country Development Strategy Statement submissions (CDSS), twelve USAID's listed land degradation as an important development constraint.

Of these, Senegal, and Mali have proposed longer term (8-10 years) forestry and land management projects as significant components of their new project portfolios.

An Africa Bureau paper on Guidelines for Donor Coordination approved in November 1984, identifies efficient management of natural resources, including water, trees, soils and rangelands, as integral to assured food availability, one of three core topics to be given priority in host country/donor policy dialogue.

#### Longer term commitment to forestry involvement

- o The Peace Corps, with the encouragement of a transfer of AID funds that allowed that agency to include African in-country training of both Peace Corps and local technical forestry personnel, has increased its African based natural resources personnel from 200 in 1981 to 500 in 1985. In addition the Peace Corps has launched a substantial Food Security Initiative, intended to be based in at least ten countries in Africa, with 20 percent of the effort to be devoted to soil and water conservation and tree planting, to support agricultural production initiatives. The program is intended to be continued for at least ten years, and the multidisciplinary teams including forestry personnel to be based in each country are expected to number from 75 to 150 volunteers. Although the term of service would not be longer than the regular tour of duty, volunteers would overlap to carry on the evolving initiatives.

- o An innovative Natural Resources Program Matching Grant for non-governmental agencies started by the Food and Voluntary Agencies Bureau of AID has resulted, in the case of CARE alone, in an increase in agroforestry and related projects from 2 in 1981 to 29 in 1985, worldwide, half of them in Africa. Another FVA Matching Grant has supported natural resources management activities sponsored by CODEL in Africa. Recognizing the longer term nature of natural resources rehabilitation programs, FVA is now in the process of developing "Partnership Grants", which will be five years in duration, to replace the "Matching Grants", which were typically for a three-year period.

#### Technology Research, Development and Transfer

Several new longer term research initiatives are underway:

- o To address the task of genetic improvement of tree seed sources and improvement of nitrogen fixing capacities of trees AID/W tentatively approved, beginning in FY 1987, funding an African-based capability for producing, testing and distributing species-specific inoculants for nitrogen fixing trees. Other donors have expressed willingness to fund related programs for other genetic improvements, through tissue culture, vegetative propagation and other techniques, as well as seed-bank and distribution programs.
- o AID has also approved development of a research program to quantify more accurately the level of agricultural food crop yields which can be achieved through such low-cost biotechnical measures as selected tree planting and other soil and water conservation techniques based on current planting by farmers already using such techniques.
- o (Research undertaken during the past two decades did not use methodologies which permit comparison of results of crops grown under tree-enhanced fields and those cleared of trees, although many visual and research tests suggest that from 20 to 100 percent increases in food crops per hectare can or could be achieved, while at the same time improving soil quality and producing necessary fiber, fuel, fodder and fruit.)

- o Giving practical effect to the incorporation of agro-forestry in the long range Agricultural Research Plan, the following Missions have already included testing of tree planting techniques as soil and water conservation measures as part of their quite substantial new Agricultural Research projects: Malawi, Mali, Burundi, Kenya, Gambia, Lesotho, and Senegal.
  
- o In addition, three of the International Centers for Agricultural Research which are supported by AID and other donors include research on the contribution of selected tree planting techniques in their current programs: IITA in Nigeria has carried out an eight-year research program on "Alley cropping", using leaves of leucaena and other leguminous trees as a mulch to substitute for the more expensive and, in Africa, often less effective commercial nitrogen fertilizers; ILCA is developing improved fodder sources from trees and other woody perennials; and ICRISAT has now included agro-forestry as part of its African based research program in Niger.

## VI. THE GREENING OF AFRICA IS POSSIBLE

The initiatives described in this overview give strong indications of the existing potential for a rapid "greening of Africa" if donors and Africans exert the will power and desire to move ahead in replicating efforts already under way.

Peace Corps and Tree Project training programs can easily be expanded at comparatively minimal costs.

Improved food crop and tree seeds adapted to and developed in Africa are already being turned out and seed farms and distribution centers can be quickly set up, decentralized throughout the African countries which want them.

The large volume of informal tree planting already under way can double its output if two new inputs -- improved seeds and bunding of fields to conserve water -- are added to these efforts.

Here is an illustration of what potential could be achieved with the addition of only these two variables -- recognizing that locally produced rhizobium and nitrogen inputs from leguminous trees could provide additional growth stimulants.

This example adapts the ideas of Nobel Laureate Norman Borlaug, whose major emphasis has so far been on using imported commercial fertilizer and more sophisticated water conservation techniques:

Food production has declined by 20% per capita during the past two decades, a period during which population has increased about 3% per year in most countries in Sub-Saharan Africa. With this kind of squeeze, less food to feed more mouths, how can one talk of the "greening of Africa";

Actually, although it may seem implausible, the application of simple arithmetic suggests that the task is not impossible. Consider the following:

- Only 9% of the seed planted in Africa (FAO) at the present time is from improved varieties. This compares with 44% in LA, 32% in NE and 23% in Asia. Locally improved varieties can reportedly increase production of maize, sorghum or millet by 30% or more, i.e. from 650 kg/ha/annum to 950 kg/ha/a.

- Very little land is banded to conserve water, but when this is done, the water conserved is substantial. A recent study in Somalia (AID 1985) showed that banded fields first improved in the early 1960's were still producing 50% more than those not created (initially production doubled) even though in many cases the bands had deteriorated for lack of maintenance. Banded farms also contributed to changing the traditional grain/pasture rotation in favor of continuous cultivation of sorghum and increased amounts of maize. Although the Somalia tests were basically earth banded, these collected naturally regenerated vegetation and trees.

Let us assume a model area which includes one million people in an area of 90,000 hectares of which a third is arable, that is 30,000 hectares. Current yields without improvements are 650 kg/ha/annum, or 19.5 million kg total per year from the 30,000 hectares.

Suppose an intensified program is launched in this region which affects half the area. (Only half the area is selected on the grounds that rarely do demonstration plots produce 100% success: half the farmers do not participate or half the seeds do not germinate. The results of course could be higher).

- Improved sorghum or millet seeds are brought in and effectively increase yields by 30% on half the land (15,000 ha.) or an increase to 12,675 metric tons. (Without the improved seeds the total would have been only 9,750 metric tons.)
- Additionally, it is assumed that half of all these fields (15,000 ha) are also banded, producing in the first instance a doubling of yields, or 25,350 metric tons on the improved fields.
- Thus, yields could increase in the region as a whole from 19.5 metric tons per year to 35,100 metric tons on the total of 30,000 hectares, with the introduction of only two variables, improved seeds and banding. See chart following.

Far from being implausible, the Greening of Africa is possible, and possible in fairly early stages if NGO's, Peace Corps, PVO's and private farmers and technicians are encouraged and willing to take these steps now.

CHART SHOWING TOTAL PRODUCTION INCREASES  
WITH ADOPTION OF TWO VARIABLES:  
BETTER SEEDS AND BUNDING

Total Land 90,000 ha.	Original Yield	Improvements	
		Imp. Seed	Bunding
A 15,000 ha. R not subj. to A improvements	650 kg/ha/a = 9,750 m.t./a	Non-Adapted	Non-Adapted
B 15,000 ha. L subject to E improvements		Adapted: 30% increase = 12,675 metric tons/a	Adapted: couple yield (includes seed) = 25,350 m.t./a
L A N D			
N O N 60,000 A R A B L E hectares	-	-	-
	-	-	-

Total production from 30,000 hectares

Unimproved land - 9,750 metric tons/a  
Improved land - 25,350 metric tons/a  
35,100 metric tons/a

Compared with 19,500 metric tons/a from 30,000 ha.  
if no changes are made.

New York Times, April 4, 1985

# To Improve African Crops

By Richard Critchfield

BERKELEY, Calif. -- What can be done to end the famine in Africa?

We can integrate existing knowledge about how to improve crop yields, and can undertake demonstration projects in Africa.

In addition to the starving children haunting our TV sets, Africa's 14-year drought afflicts 30 million people. The Agency for International Development predicts that as many as one million people may die of starvation in the next year. Neo-Malthusians talk about too many Africans for the ever-drier land. The Sahara, meanwhile, creeps southward.

Africa's crisis comes just as the Green Revolution in plant genetics and farming methods has made progress in rescuing far larger populations in Asia. China now produces more wheat than the United States and continues to improve nutrition. India lags in birth control but has more than quadrupled wheat output since 1957, allowing it to export a little this year.

Africa's crisis arrived just a few years after the Ford and Rockefeller foundations, which were responsible for Asia's Green Revolution, phased out old agricultural programs and let their scientists go. The Agency for International Development, too, in a series of cutbacks, has lost much

Richard Critchfield, author of "Villages," writes on rural development for The Economist of London.

of its competent technical staff.

What survives is a well-established global network of 13 agricultural research centers that pool data and genetic information on crops. New varieties must constantly be bred to combat disease organisms and insects. But the centers, mainly government-supported, lack the flexibility of the old programs run by foundations. Some agricultural scientists of the old guard recently formed the Winrock International Institute for Agricultural Development, near Morrilton, Ark., which may, in time, provide solutions for Africa.

The Rockefeller Foundation has dropped out of conventional plant-breeding altogether and has replaced that enterprise with an \$80 million program in genetic engineering. The benefits of the new program likely will not come for years. The Ford Foundation has directed its programs to attack rural poverty, with an emphasis on social sciences.

One member of the old agricultural school, however, has a timely plan to grow more food in Africa. Norman Borlaug, the 71-year-old Iowa plant breeder who won the Nobel Peace Prize in 1970 for producing dwarf wheat, which increased food supplies in India and China, says the first step should begin during the next planting season. Dr. Borlaug suggests integrating available knowledge on crop and sorghum at international research centers in Mexico, India and at Texas A. & M. University.

"The nuts and bolts are lying around but nobody puts them together," he said recently. "They've got

quite a lot of unassembled data for Africa on varieties or hybrids that have been tested in many places, on the use of fertilizer, methods of planting, control of insects, weeds, diseases and use of moisture. Starting this next planting season, we ought to pick one or two African countries where we have plenty of data, put all that data together, come up with a production package and B&E planting tests on several dozen farms."

"Within two years, he says, the improved production, adjusted according to test results, could be transferred to thousands of farms."

The most difficult battle against famine has more to do with psychology and politics than with horticulture, Dr. Borlaug says: once African political leaders and economic planners see that crop yields can be greatly increased, they need to be encouraged to follow up in three ways. They must get fertilizer to villages six weeks before planting time, provide credit to farmers who will pay off debts after the harvest and insure a fair price for crops.

"When you've got the people all stirred up, assuming the technology has created a big jump in yield, then whoever's running the program has got to be quite a psychologist," Dr. Borlaug said. "He's got to tell the political leader, 'Here's your chance for a breakthrough.'"

In short, he would do in Africa what worked in Asia. "You've got to make things happen," says Dr. Borlaug, who has been improving crop yields for 40 years. "They don't happen by themselves." □