

Agriculture Department
Lahore

March 27, 1967

Sir:

Dr. Norman E. Borlaug, wheat breeder from Mexico, has visited West Pakistan during March 1967 and submitted brief observations on the wheat improvement program to President Ayub Khan and Minister Khuda Bakhsh, at their request.

These reports are being distributed widely to officers of Agricultural Research and Extension, because of their immediate value to the food production drive.

Copies of Dr. Borlaug's two papers are attached for your study, under the following topics:

Report to President Ayub:

1. Fertilizer inputs
2. Farmers have proved they are ready to accept rapid change
3. Floor support prices for wheat
4. Funds to defend a floor price
5. Warehousing
6. Wheat production will affect the revolution in other crops

Report to Minister Khuda Bakhsh, Supplementing the President's Letter

1. Fertilizer requirements
2. Fertilizer credits to farmers
3. Floor prices for wheat
4. Storage for wheat
5. Mechanization of wheat production
6. Extension plans for 1967-68
7. Field days for policy makers and planners
8. Aphid control
9. Hail insurance
10. Continued danger of rusts
11. Wheat research progress
12. "Brain drain" in agriculture

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Karachi
March 21, 1967

President
Mohammad Ayub Khan
President's House
Rawalpindi

Dear Mr. President:

You requested in our meeting at Iyallpur on March 13, a letter summarizing the points covered, which I am pleased to state below.

The Accelerated Wheat Improvement and Production Program is on target and ahead of schedule. Great progress this winter in the irrigated areas is concealed by drought in the barani areas. The harvest will be better than most officials anticipate, and larger than last year.

I observe within the past year a complete change of psychology among farmers, policy makers, and scientists, as your Government's "Grow More Food Campaign" has moved into high gear. Enthusiasm has replaced skepticism. The remaining doubters are silent.

However, this is no time to relax. You need an expanded offensive. Self-sufficiency of wheat production is within your grasp. This target can be achieved during 1967-68 crop season, two years ahead of schedule, if there is near normal rainfall and the following conditions are met:

1. Fertilizer inputs

Fertilizer supplies in West Pakistan, from manufacture and imports combined, must be increased beyond present targets.

Research and extension officers who are supervising demonstration plots of dwarf wheat on private lands now estimate that dwarf wheat acreage for the next season, 1967-68, will be about 50% of the irrigated wheat acreage, or about 4 million acres. Present fertilizer import plans are based on only two million acres of dwarf wheat next winter. There is some guesswork in such estimates, but my interviews with farmers in seven irrigated districts would support the higher figure of 4 million acres.

Therefore present targets for fertilizer supply in West Pakistan --- 14 lakhs tons for all crops in the year starting July 1, 1967, of which 80% would be nitrogen fertilizer and 20% phosphate fertilizer --- are low in my opinion.

I reviewed the fertilizer calculations of Government planners and believe that 18 lakhs tons will be closer to the actual demand, including buffer stocks. And phosphate proportion should be raised to 33% of the total.

This means expanding nitrogen availability to about 12 lakhs tons (ammonium sulphate basis) and phosphate fertilizer to about six lakhs tons (super-phosphate basis).

Fertilizer trials on wheat this winter will show we have been under-estimating phosphate requirements. Phosphate deficiency in the soil is both more widespread and of greater magnitude than previously estimated. Hence I emphasize that fertilizer supply should be divided 67%-33% between nitrogen and phosphate types.

Phosphate fertilizer must be applied prior to, or at the time of wheat sowing to be effective. It is therefore needed at the village level by September 15. Thus procurement orders must be placed immediately, in order to allow six months' delivery time.

Bureaucratic fertilizer distribution methods have contributed during the past year to poor fertilizer usage in some localities. It is suggested that a buffer stock of both nitrogen and phosphate fertilizers, equal to 4 months' requirement, is needed at all times. This will reduce distribution bottlenecks.

As far as possible, urea (46% nitrogen) should replace ammonium sulphate (20%) and triple super phosphate (46% P₂O₅) should replace super phosphate (18½%), in order to reduce pressure on Karachi port and the railroads.

2. Farmers have proved they are ready to accept rapid change

Just one year ago, when I visited West Pakistan and predicted that farmers were ready for rapid changes in wheat technology, some Government officers called my estimates crazy. Today official records for West Pakistan show that fertilizer applied to the wheat crop of 1966-67 is of the magnitude 250-300% compared to the previous year. This happened in spite of poor distribution at the start of the season, tardy credit, and irrigation water shortage in some areas.

In my opinion, a further increase of 250-300% in fertilizer applied to wheat can occur in 1967-68, if supplies arrive at village level at proper time.

3. Floor support prices for wheat

Government has failed to use floor prices as an economic tool to stimulate maximum wheat production.

To be effective a floor price must be announced before wheat planting. For the 1967 crop, no floor price has yet been announced, even though harvest has begun.

For the next crop, the floor price on wheat must be announced by September 15, before planting begins, in order to encourage a farmer to use heavy fertilizer, and be confident of recovering his investment.

4. Funds to defend a floor price

A floor price must be defended at harvest time, in the spring of 1968, by timely Government purchases of grain in sufficient quantity in the mandi towns to prevent prices from falling below the floor, and thus causing a farmer to lose money on his crop.

Nothing will set back your agricultural revolution more, as you move from wheat deficit to self-sufficiency, than for the farmers to lose money on the first big crop.

The Food Department must have sufficient funds before harvest to stabilize prices, and the stored grain can be placed under bank loan, thus reducing appropriated funds.

5. Warehousing

Adequate storage bins and godowns must be available in the major production areas where the Food Department is likely to make purchases.

Past estimates suggest that when West Pakistan produced a 4-million ton wheat crop, less than 1 million tons left the village and went into commercial trade, thus requiring storage. When production reaches 6 million tons, it is wise to estimate that 2 million tons will leave the village, and require commercial storage.

Action must be taken immediately to survey capacity, and to remedy the shortage. Storage capacity must be calculated to replace the previous year-around flow of PL-480 wheat, which enabled you to keep your storage at a minimum.

Wheat purchased by the Food Department at harvest can be fed gradually back into commercial grain channels, which will stabilize food prices between harvests. And as the godowns are emptied, the same storage facilities can be used for rice and maize, which are also likely to be available in far greater quantity than heretofore.

Storage facilities require large investments, but the foreign exchange component should be low.

6. Wheat production will affect the revolution in other crops

The revolution in wheat production will spread rapidly to other crops (maize, sorghum, rice). Much of the new wheat technology will be transferred with minor adaptation and proper guidance to other foodgrain crops.

Mr. President, Pakistan has within reach the solution of its wheat deficit, and should shortly attain self-sufficiency in all foodgrains.

Pakistan must succeed, not only for Pakistan's sake, but also to serve as a model for a world-wide revolution in food production.

I am proud to have participated in a minor role, with your policy makers, scientists, and farmers, in this "Grow More Food Campaign". I wish you success in reaching your production goals ahead of schedule.

Sincerely yours,

Norman E. Borlaug
Visiting Consultant in Wheat Improvement
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Calle Londres 40
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Karachi
March 21, 1967

Notes on Wheat Improvement for Minister Khuda Bakhsh

by N.E. Borlaug

1. Fertilizer requirements

Fertilizer consumption is an important barometer of the agricultural revolution.

The current wheat crop (1966-67) received approximately $2\frac{1}{2}$ times the fertilizer applied to wheat the previous year. Your planners have done an excellent job of recalculating fertilizer imports to meet expanding need. Nevertheless, I feel the targets must be raised again for 1967-68.

Fertilizer trials conducted on a large number of private farms during the current wheat crop cycle clearly indicate widespread phosphate deficiency, and the need for raising of import targets for phosphate.

Many trials have been found in which maximum nitrogen applications alone (138 pounds N per acre or 6 bags) produced only moderate yield response, while half that much nitrogen, combined with 40 pounds of P_2O_5 per acre (that is, 3 bags ammonium sulphate and 2 bags superphosphate) produced very large yield increases.

Under-estimation of phosphate requirements in the past has probably resulted from inadvertently locating a large proportion of experimental plots near villages and along highways and roads, where more barnyard manures have been used, and the residual phosphate from this source has concealed the general nutrient deficiency. Under such conditions, applications of nitrogenous fertilizer alone gave favorable increases.

This year most farmers used only nitrogenous fertilizer on wheat. On the next wheat crop thousands of demonstration plots will be needed on private farms to promote the combined nitrogen-phosphate benefits.

The timing of phosphate application is important to plant growth. All phosphate should be applied before sowing, so that it can stimulate seedling development and tillering. That means phosphate fertilizer for wheat should reach village level before planting begins -- by September 15.

Phosphate response in wheat will normally indicate equal response for other major crops, such as cotton, maize, sorghum, rice and sugar cane grown on the same soils. Therefore, I conclude from this year's decisive phosphate response in wheat trials that your planners should now contract for next year's fertilizer supply on the basis of 67% nitrogen fertilizer, and 33% phosphate, nutrient basis.

The adjusted targets for the 1967-68 fiscal year might therefore be raised to approximately 12 lakhs tons nitrogen fertilizer (ammonium phosphate basis) and 6 lakhs tons phosphate fertilizer (super-phosphate basis).

Imports in the form of urea (46%) and triple super-phosphate (46%) will save greatly on the tonnage handled by Karachi port and the railroads.

2. Fertilizer credits to farmers

Tardy credit for fertilizer, at least at the start of the wheat season, is reported to have been a bottleneck on the present wheat crop.

If fertilizer consumption is to be further expanded by 250% in 1967-68, as it should be, credit in even larger amounts will be needed, and should be available in advance of sowing.

3. Floor prices for wheat

Floor prices for wheat, announced before the planting season in September, 1967, can be an effective stimulant to maximum planting, and maximum use of fertilizer. The Government neglected this important economic tool for the 1966-67 crop.

I suggest the Government call immediately for a study of a realistic floor price for 1968, which will stimulate maximum planting and fertilizing in the fall of 1967.

A floor price never requires the Government to buy the entire crop, but it requires that the Food Department buy aggressively and selectively in any area of surplus, and in sufficient quantity to prevent local grain merchants from driving down the price, and thus cause farmers to lose money on a big wheat crop.

It is possible that the Government could use selected grain merchants as Government agents to buy wheat at the floor price, store the wheat in private godowns, and to cover the cost of the crop with bank loans, secured by godown receipt. This would reduce the need for appropriated funds.

The same economists who study floor prices might also recommend to the Government the probable volume of wheat purchases that will be needed to defend the floor price, at different levels of production during the 1968 harvest.

4. Storage for wheat

Storage capacity for foodgrains must be increased by 1968, not only for wheat but also for maize and rice.

When West Pakistan produced a previous wheat crop totalling 4 million tons, I am told that over 3 million tons never left the village; less than one million tons was sold into the commercial trade, and needed some kind of storage. An important influence on this low requirement for storage was the gradual import throughout the year of PL-480 wheat, which was distributed as fast as it arrived, and therefore required minimum storage.

In West Pakistan the Provincial Food Department is said to have 5,00,000 tons of grain storage capacity, and the Central Food Ministry another 5,00,000 tons storage.

The Third Plan authorizes construction of an additional 5,00,000 tons of new grain storage capacity in West Pakistan. Even this new capacity is likely to be insufficient.

A 6 million ton wheat harvest in 1968, which is possible, might well present the demand for immediate storage capacity of 2 million tons.

The Government should call for an urgent survey of present capacity, both public and private, determine the storage capacity target for 1968, and proceed with the construction of the Third Plan storage program as rapidly as feasible.

Type of storage facilities should also be re-studied. The "bin-type" storage constructed in the First Plan is superior to the "house-godown" storage constructed in the Second Plan, especially for insect,

rodent, and moisture control. Both are constructed mainly with local materials. But the "house-godown" type requires less labor for filling. The labor problem for "bin-type" storage can be solved with elevators, either screw-type or bucket-type.

Storage is a critical problem for a nation approaching self-sufficiency in foodgrain, because for the first time it must be able to carry its own harvested grain crops throughout the year.

5. Mechanization of wheat production

The Machinery Demonstration Unit imported into Pakistan, to study the use of tractor equipment under irrigated conditions, is now operating successfully in Sahiwal district, and will be demonstrating this spring the advantages of combine harvesting for larger wheat farms.

A separate report is being submitted to the Secretary of Agriculture on the progress of the Machinery Demonstration Unit.

An improved rabi drill, bullock-drawn, and able to apply seed and fertilizer simultaneously in controlled amounts, and at controlled depths, was imported last December and is now undergoing trials. This drill places fertilizer in a band a short distance from the seed, and thus prevents chemical injury to the seed, even when heavy applications of fertilizer are made.

On the basis of experience so far, it is probable this new rabi drill should be reproduced in Pakistan in large numbers, in both private and public sector.

I am convinced this drill will contribute to increased wheat yields in the future.

6. Extension Plans for 1967-68

The Extension Service successfully introduced dwarf wheat varieties and the new production technology into thousands of villages this season. The new crop and its cultural practices were observed by hundreds of neighbors of those who grew it. In every village where I made inquiry, the local growers of 1967 estimated that half of all the irrigated wheat land in their village would be planted to dwarf wheat in the 1967-68 crop. The black market price still prevailing on seed of the new varieties is proof of its wide acceptance.

I had opportunity to observe with Director Shaffi Gill and members of his staff in the Punjab some of the 5000 demonstration plots completed in that region. The farmers who grew these crops were invariably proud of them, and told of hundreds of casual visitors who asked question about the new wheats. In the Sind and Frontier I visited the demonstrations with the Research Service, but unfortunately missed seeing the Extension Directors, Dr. Mohd. Sharif and Malik Fazel Dad Khan, both of whom were on tour. All three regions deserve Government commendation on the number and quality of the demonstrations.

The fertilizer trials on private dwarf wheats in 1966-67 demonstrated:

115-40-0
69-40-0
0-0-0

In order to highlight the new information on phosphate response, the trials in 1967-68 should be altered to demonstrate:

115-40-0
115-80-0
0-0-0

It is important that the next cropping season achieve a breakthrough in phosphate usage.

7. Field days for policy makers and planners

Field days have proved effective for farmers. Now we should have field days for policy makers and planners. They should see the crop in the field, not behind the desk. They should talk to farmers who grow it. They should see a research station where the agronomic trials can be studied.

A one day tour for Lahore policy makers and planners would reassure them about the fantastic rate of change in agriculture.

8. Aphid control

Aphids are a common insect pest, injuring the wheat crop throughout the world. But aphids have not previously reduced wheat production in Pakistan because of the sparse plant population, which discourages insects.

As better fertility and better irrigation practice produces a denser stand of wheat in Pakistan, the environment becomes more favorable to the increase of aphids.

In most crop seasons the aphids will be unable to achieve destructive proportions because of their natural predators --- the Lady Beetle and the wasp. Under certain conditions, however, the biological balance may shift in favor of the aphid (such as a late frost which kills the predators). Under such conditions, within two weeks a tremendous infestation can develop, which will reduce wheat yields.

Aphids are easily controlled by chemicals, but chemicals should not be used except for epidemic outbreaks, which generally occur only in very localized areas.

It is therefore necessary for the entomologist to survey the wheat farms in his area every 10 days, from heading to dough stage, estimating the aphid population by counting the insect population per spike. Such surveys cannot be made from behind a desk.

9. Hail insurance

Heavy hail storms just before harvest can completely destroy a wheat crop. Hail storms are always restricted to narrow strips, covering an area of a few hundred to a few thousand acres.

Pakistan's wheat farmers in the past, growing a crop generally without fertilizer, have accepted their hail losses as a natural risk. But now, with heavy fertilizer, the losses from hail damage can be ruinous.

In Mexico a voluntary and mutual hail insurance plan is available to farmers. Premiums are low, and the protection covers only the cost of inputs, not the potential profits.

When a farmer obtains a production loan for the cost of fertilizer on wheat, the hail insurance is normally incorporated in the loan by the loan agency.

The Government of West Pakistan might investigate such protection from its insurance companies. It will be important in the future.

10. Continued danger of rusts

The dangers of rust (fungus disease of wheat) will increase as fertility is raised, and the farmer achieves a lush, heavy crop. The use of rust-resistant varieties is the only practical protection.

The dwarf wheat varieties which Pakistan imported from Mexico were originally selected for their natural resistance to the prevailing races of rust. Nevertheless, new rust organisms are constantly emerging. Therefore, no one can predict how long the present dwarf wheat varieties will remain resistant.

An aggressive local wheat breeding program is necessary to provide a constant flow of new varieties, of different parentage, likely to carry resistance to different races of rust.

Pakistan should never rely on less than six extensively grown wheat varieties, of widely differing parentage, as a hedge against a new epidemic of rust.

Fortunately your breeding program is rapidly approaching this goal, as noted below.

11. Wheat research progress

The Coordinated Wheat Improvement Program under the leadership of Dr. S.A. Qureshi and three other regional botanists is making excellent progress. Many new dwarf lines developed from crosses at the three Agricultural Research Institutes of West Pakistan will be entering yield trials next crop season. A few were tested this year. From these lines will come new commercial varieties, some of which are certain to be superior to any now available to farmers. They also will offer a wider hedge against new races of rust.

Seed increase of the best of the new lines should start in 1968 and reach general commercial introduction by 1970.

Mexipak-65, a variety developed partly in Mexico and partly in Pakistan, will be ready for sowing on 200,000 acres in the autumn of 1967. This variety is said to have superior chapati-making quality.

Indus-66, another variety developed jointly in Mexico and Pakistan, will also outyield the present dwarfs Penjamo 62 and Lerma Rojo-64, and will be available this year.

The wheat botanists of the three regions have achieved effective coordination, and are making rapid progress.

The arrangements for a summer nursery for 1967 are complete, and should overcome the disappointments of 1965 and 1966.

12. "Brain drain" in agriculture

West Pakistan faces a new kind of brain drain in agriculture. Private sector industries working on manufacture or distribution of fertilizer, machinery, and insecticides are scouting the Government services to hire the best scientific talent.

I spoke to the Representative of one fertilizer manufacturing company who said he would hire 30 additional Pakistani agricultural scientists for his staff within the next year. These men would be used for fertilizer demonstrations, market surveys, and private dealer relationships. The men best qualified for these jobs are the brightest employees of the Agriculture Department, the University, and other agricultural agencies. The private company is prepared to pay from two to two and one-half times the Government salary to get the best men.

No doubt similar staff demands will arise as each of three or four other fertilizer companies builds up its staff for manufacture and sales in Pakistan. Farm machinery dealers have already hired some.

There is strong possibility that these companies will cause a "brain drain" of at least 100 to 200 officers from the Government within the next year or two, and they will be looking only for the best.

This has been the pattern of the agricultural revolution in other countries. I saw it happen in Mexico.

No Government retaliation is proper. The Government must organize a special effort, by promotions and other recognition, to hold some of its best scientists in key positions. If this is accomplished, younger scientists will develop under their leadership and soon make good the losses.

Lyallpur University will also be under pressure in two ways. It will lose some of its staff. And it will be called upon to train a larger number of men of excellence. The "brain drain" will affect only the most talented officers, and it cannot be solved by the transfer of mediocre men.

The "brain drain" would justify mutual consultation between Lyallpur University and the Agriculture Department, to find solutions for personnel problems which affect them both.

N.E.B.