

A Review By Norman E. Borlaug

Of The Report:

The Social and Economic Implications of Large Scale Introductions of

of New Varieties of Food Grain

Country Report: Mexico

by

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I have read and re-read this report carefully three times. I must conclude after carefully considering all aspects of the report, that the authoress began writing this treatise to prove that the so-called green revolution technology was responsible for the failure of the collective ejidal system.

There is no doubt but that the authoress is sadly disillusioned by the failure of the collective ejidal system to continue to evolve and flourish, since 1940, as was visualized and hoped for by she and many others, including myself. The fact that many factors, including political and economic decisions made by government leaders, intervened to prevent this from happening seems to have disillusioned her. It appears she has consequently decided to look for a culprit or villain responsible for its failure. So she proceeds to attribute much of the failure to the Cooperative Mexican Ministry of Agriculture-Rockefeller Foundation Agricultural Research and Production Program. Certainly this was a poor choice for her arguments are not convincing.

At the outset she shows an amazing lack of knowledge about the status of Mexican agriculture over the early part of the period her manuscript purports to describe. She states, or at least implies, (erroneously, and possibly even maliciously) perhaps to strengthen her argument for the adverse effect of the green revolution on the communal ejidal system, that the Rockefeller Foundation's collaboration with the Mexican Ministry of Agriculture was established and conducted because of the strong influence of the American Ambassador, This is absolutely not true. The program was established as the result of a direct request by the Mexican Government to the Rockefeller Foundation for technical assistance to strengthen research and train young Mexican scientists.

At no time - from the time of the establishment of the Cooperative Mexican Government - Rockefeller Foundation (The Oficina de Estudios Especiales SAG) in 1943 until the completed program was transferred to the Instituto Nacional de Investigaciones Agrícolas (INIA) in 1961 - did the U.S. Government or any of its agencies have any influence on policies of the Q. E. E. agricultural program.

It is amazing that the authoress can write a manuscript of 272 pages and only casually mention in four sentences the problems of growth in population. It seems incredible that one can write an extensive social-economic treatise about "agricultural modernization" vs "rural development" while largely ignoring the accomplishments

achieved in greatly increasing agricultural production, not just in the Valle del Yaqui and Costa de Hermosillo but nation wide. She has not cited a single figure to indicate the huge increase in grain production which resulted from the widespread application of new technology developed and disseminated by the Q. E. E. program. The increase in food and fiber production during the past 25 years has more than kept pace with population growth - despite an increase in population from 18 million in 1944 to 60 million in 1975. What would the situation on food availability in Mexico be today if new agricultural technology had not been applied to increase production? Under present conditions of world-wide shortages of grain - reflecting in high food prices - where would Mexico obtain 6 million tons of maize, 2 million tons of wheat and 1 million tons of beans? Even if they could find and purchase such quantities what would such an importation represent in terms of foreign exchange expenditures?

Throughout the article the authoress speaks about the sophisticated research of the Q. E. E. This is nonsense. Either she is trying to distort the facts or she is badly informed. During the first 10 years much of the research - breeding, agronomic studies, fertilizer studies, disease and insect studies - was conducted on land in ejidos and private farms. There were no fancy experimental stations, there was very little laboratory work. The budgets for agricultural research and the facilities and equipment was simple and modest. About the most

sophisticated equipment that was available during the first 10 years was a couple of cheap microscopes, a hand operated calculating machine and an autoclave for sterilizing media for culturing disease organisms.

Was this sophisticated equipment?

Virtually all of the research was done in the field. Often the Q. E. E. staff members together with their young Mexican colleagues spent 3 consecutive months installing field tests, pollinating, taking notes in many different parts of the Republic. And the majority of these experiments were conducted under rainfed conditions not under irrigation. Frequently the research staff camped out and cooked their own food.

Was this sophisticated research?

The wheat breeding program produced a large number of varieties (about 20) between 1947 and 1961. Each one was superior in one or more important respects to the variety it replaced. All were tall strawed varieties. All outyielded the original "criollo" varieties even without the use of fertilizer. All had better disease resistance - especially to rusts - than the "criollo" varieties and hence growing them reduced risk from losses caused by rusts. There was nearly always ample seed of new varieties available for all ejidatarios and private farmers by three years after release, at the latest. These varieties could be and were sown and cultivated in the same way as the traditional "criollo" varieties. They presented no unusual problem in handling by either the ejidatario or small farmer.

The use of these improved varieties spread rapidly to ejidatarios and small farmers in both Sonora and the Bajio in the period 1950 - 1961, despite the weakness of the seed multiplication organizations, whose efficiency was often reduced because of lack of trained people and by an over abundance of bureaucracy. Much of the seed of the improved varieties spread from farmer to farmer under its own initiative once its value became evident. The authoress is wrong in saying the spread of the new wheat seeds was slow. The truth is the use of the new seeds and improved technology spread faster in Mexico than had ever been observed elsewhere previously. This experience was to be repeated again and again in India and Pakistan in the period of 1965 - 1970.

One of the most disconcerting aspects of the article is that the authoress seems to believe and imply that because a small ejidatario or private farm is illiterate, he is ignorant, if not stupid. We have learned from personal contact with peasant farmers in many countries this just is not true. Repeatedly in the past 15 years we have seen new technology spread from a relatively few demonstrations via peasant farmer to peasant farmer contact at a very rapid rate wherever government policies are such that they stimulate adaption. If inputs (e. g. fertilizer) and credit with which to purchase it, together with a guaranteed fair price for the grain is assured, the small farmer is innovative and will adopt a new technology if it is capable of increasing his yields substantially and thereby make

the change worthwhile.

The authoress seems to insist on underestimating the shrewdness, capabilities and common sense of the small farmer. This indicates she does not know peasant farmers. She implies the need for strong paternalistic protection to save the peasant farmer from his own folly. The truth of the matter is that what is most needed to assist the small farmer is sound government economic policy which includes the availability of credit and inputs such as fertilizer and a favorable price for the grain.

It should be pointed out when chemical fertilizer recommendations were first introduced on wheat in both the Bajio and Sonora some ejidatarios and small farmers sold their fertilizer rather than apply it. This folly lasted only one (1) or at the most two (2) years. Once they saw the benefits of the fertilizer they had sold on grain yields on their neighbors' fields, this folly was promptly terminated and the fertilizer was applied on their own fields rather than sold for cash.

In the period of 1953 - 56 when the use of fertilizer was being introduced, there was still a very great shortage of technical people - so much so that it was impossible to rapidly build an effective extension program. After all one does not suddenly snap ones fingers and have by magic many well trained scientists appear. Nevertheless, the research workers held many farmers meetings throughout the wheat growing areas before planting. These meetings were organized

and promoted by the Agente de Agricultura of each state. Invariably the representatives of the Banco Ejidal y Banco Agrícola attended. Both private farmers (large and small) and ejidatarios attended. The presentations at these meetings were broadcast over local radio stations. Each spring when the grain was beginning to ripen, a considerable number of farmers field days were organized - both on experimental stations and on farms or ejidos - where demonstrations of seed multiplication and research plots were explained to all who attended. The attendance at such events increased from less than two dozen participants to several thousand in a period of 5 years. This extension effort and procedure, despite the restriction imposed by shortage of trained personnel, was the best that could be done by the research scientists in the early 1950's. Apparent extension activity shortcomings by the Q. E. E. in the period 1944-1956 may look like over-sights to the authoress - looking back 25 to 30 years - but where was the scientific manpower? Moreover, where was the budget for establishing an extension program within the Secretary of Agriculture?

The authoress' generosity in criticizing the Q. E. E. program for not launching an adequate extension program in the period from 1944-1953 indicates failure to comprehend the handicaps imposed by lack of trained scientists in Mexico. She apparently does not know that when the wheat and maize research programs in the Q. E. E. were launched in 1944 there were only four fairly competent Mexican scientists working half

time on wheat and half time on maize in the entire Republic. Moreover, much of their energies went into necessary government administrative work. All four of these research scientists were in the Oficina de Campos Experimentales, S. A. G. So the Q. E. E. training program for young Mexican scientists began in 1943 without any trained Mexican scientists. It took 17 long years to provide research experience and advance degree training to develop the scientific staff necessary to launch INIA. Nor is this a unique situation. A recent study indicates it will take about 17 to 19 years to train a corps of Algerian scientists, adequate in number and experience, to staff the national agricultural research institute and research stations that the Algerian Government wishes to establish.

It always looks simple for critics to glance backward 25 years and criticize what was done or not done in research or extension but unless this is done with some reasonable perspective of the obstacles that were being confronted by the programs of that period they contribute merely academic smog rather than enlightenment.

The authoress throughout the manuscript implies that the research program of the Q. E. E. seemed to be dictating overall agricultural policy of the Mexican Government. This is incorrect, and nonsense. Had we (RF scientists) ever attempted to do so almost certainly we would have been asked to promptly leave Mexico. Among other innuendos, one is that the Q. E. E. research scientists had a hand in encouraging the government to build huge dams to develop

"oasis" in Sonora. The truth is we were never consulted about such decisions. Nor were we consulted about mechanization of wheat production.

When the Q. E. E. began to do research on wheat in 1945 in the Yaqui Valley, Angostura Dam was already providing controlled irrigation to land in the area. Angostura dam had been built during the Cardenas administration. Moreover, the entire wheat crop was already mechanized. Q. E. E. had nothing to do with the mechanization although the authoress implies we did.

The authoress also indicates a very weak background of history of the problems that faced Sonoran agriculture in the 1930's and 1940's. The area was seriously isolated from the rest of the Republic. It lacked communications. There were no roads to the south of Huatabampo. The only transport to the south was by the Southern Pacific Railroad, which was in a sad state of maintenance. Since Sonora is in an area where winter frosts - December to February - are likely to occur in most years, winter vegetable crops for export cannot be grown successfully. That meant that Sonora had to produce staple non-perishable crops that could be stored and shipped (over many months of time) to the center of the Republic by railroad. This meant the only crops that could be grown successfully and find a ready market were rice during the summer and wheat and flax during winter. The latter crop was introduced in the 1941 - 43 period following several disastrous wheat crop losses because of severe rust epidemics. Moreover, cotton was

a risky crop (summer) because of the difficulty of controlling insects - since this was before the time of modern organic insecticides.

So what would the authoress have done had she been in charge of the wheat research program? Would she have ignored Sonora where large areas were already being grown to wheat and let rust epidemics continue to reappear? Would she have ignored the water coming from the dam and in effect condoned seeing it largely wasted in producing low yields of wheat, flax and rice? Or would she have done as we researchers in the Q. E. E. did - not only conduct research in the Valle del Yaqui, but also simultaneously in Chapingo, Puebla, Torreón, Saltillo, Querétaro, Celaya, Irapuato, León, Briseñas, Aguascalientes and Celaya? She does not seem to know how extensive and widespread the wheat research and production program was.

Throughout the manuscript the authoress greatly criticizes the diversion of agricultural funds to irrigated areas (i. e. Valle del Yaqui). She might instead better have focused her scorn on government policy which utilized most of the federal budget on other sectors of the economy and too little on agriculture. This she does not do.

It was not until 1973, following the horrendous rises in food grain and fertilizer prices - caused by world-wide shortages- that Mexican government policy began to change and give emphasis to agriculture. But never once does she mention that government funds for agriculture were badly neglected in the long period from 1940-1972

when other sectors of the economy and especially industrialization were being emphasized.

It is true of course that every effort must be made to increase the yields and production of crops on all potentially productive agricultural land - including rainfed - wherever agriculture has the possibility of becoming a viable activity. This does not, however, mean that scarce and very limited research funds should have been recklessly wasted on trying to make productive agricultural areas out of semi-desert lands which receive 150 - 250 mm. of precipitation even though unrealistic agrarian reform program sometimes has distributed land in such areas where agricultural exploitation will never be feasible.

The manuscript currently gives the impression that virtually all of the Q. E. E. research program was conducted on irrigated land. This is not true. Within the limits that budget, and trained personnel and travel permitted, we conducted research on the most important basic crops (excluding cash crops such as sugar, coffee, fruits, etc.) in all the important producing areas, under both irrigated and rainfed conditions. In maize, for example, the majority of the research was conducted under rainfed conditions. In the case of wheat - since Mexico has only summer rainfall - summer wheat research was confined to areas where summer temperatures were not too high for good wheat plant development. This, because of biologic limitations of the wheat plant, restricted summer experimentation to elevations of 1800 meters

and above. Below that elevation during summer it was established by research - that wheat could not compete with corn. It is the lack of combination of favorable summer temperatures (sufficient elevation) in combination with adequate summer rainfall and suitable soil type that limits summer rainfed wheat production in Mexico. Only in certain high valleys in Michoacán, Chihuahua, Puebla and Tlaxcala does this combination of suitable conditions prevail, and only there can summer wheat compete with rainfed maize. In some of the valleys with high rainfall, the extreme weed problem virtually rules out wheat production in favor of maize. Until chemical control can be generally used, this will continue.

The authoress apparently fails to understand the effect of tempe rature, rainfall (amount and seasonal distribution) and soil type on crop adaptation. She seems to feel - wrongly - that had the wheat breeding program in the Q. E. E. been restricted to breeding for rainfed conditions that Mexico could now be producing the wheat it needs under rainfed conditions. In this she is badly mistaken.

The truth is that Mexican wheat varieties developed by Q. E. E. and more recently jointly by CIMMYT and INIA have been and are being grown extensively and successfully in many parts of the world under rainfed conditions, e. g. India, Pakistan, Turkey, Iraq, Afghanistan, Syria, Lebanon, Ethiopia, Kenya, Tunisia, Algeria, Morocco, Spain Portugal, South Africa, New Zealand, Argentina, Brazil, and U. S. A.

These countries have the right combination of favorable temperature and suitable soil combined with summer (or winter) rainfall while Mexico has only limited areas that combine these characteristics.

The authoress repeatedly implies that the Q.E.E. and INIA research program has been strongly oriented toward developing capital intensive technology only suited to large farmers. This is nonsense! The wheat and maize varieties will outperform the old traditional varieties with or without the proper use of fertilizer. But they cannot express their true genetic yield potential unless they are properly fertilized (or fed). The authoress seems to think it should be possible for a good plant breeder to produce a variety which will produce high grain yields on nutrient depleted soil. This is impossible. Much of the land of Mexico has been "mined" of nutrients by continuous cropping over decades and in the older agricultural areas for centuries of time. In the process large quantities of essential plant nutrients (nitrogen, phosphorous potash, etc.) have been removed in the grain and straw and little or none of these nutrients have been returned to the soil. The only way to increase yield significantly on such soils is to replenish the soil with the nutrients that now limit grain yield. This can be done by the application of the right kind of fertilizer, either chemical or organic - but we do not have much of the latter available in Mexico. So we must largely rely on the use of chemical fertilizer. To expect wheat or maize seedlings to grow into healthy vigorous plants and produce a high yield of grain in

soil depleted of nutrients (its food) is analogous to expecting a child to grow into a strong healthy adult without the intake of food. This impossibility should be self-evident to all people - but it seems to escape many non-biologists who want plant breeders to perform miracles which will permit world civilization to stay ahead of the population monster.

From about 1964 until 1974 Mexico followed a policy of investing heavily in various industrial petrochemical industries - while neglecting expansion of nitrogenous fertilizer production capacity. They did this despite flaring off (wasting) natural gas, (the best raw material for nitrogenous fertilizer production) from well heads and refineries. Their policy during this long period was to import cheap fertilizer from the U.S.A. while investing in other petrochemical industries. Suddenly in 1973, when world-wide shortages of fertilizer began to appear, which were shortly thereafter worsened by the petroleum crisis, fertilizer prices soared and Mexico found itself with a serious shortage of fertilizer and soaring import costs. Fortunately in 1974 the government of Mexico began, belatedly, to build a number of new fertilizer plants. Within the past year large deposits of phosphate rock have been found in Baja California. Within the next five years if wise policies are pursued, Mexico can have an enviable position in both nitrogenous and phosphatic fertilizer production. It can produce all the fertilizer it needs domestically and in addition large quantities

to Central America. It remains to be seen, however, whether it will establish realistic domestic policies which will make fertilizer available to the small ejidatario or mini farmer at reasonable prices and with credit which will enable him to purchase it and at the same time maintain a reasonable price for his grain.

In closing it should be emphasized that the breeding program and agronomic research program carried out by Q. E. E., INIA and CIMMYT have been and continue to be a scale neutral program applicable to farms of any size. The high yielding dwarf wheat varieties developed in Mexico have been successfully and extensively grown under both irrigated and rainfed conditions in many countries. Under irrigated conditions in India, Pakistan and a number of other countries, these Mexican wheats are widely sown by many small farmers (1 to 5 hectares). They are sown in the traditional way employing an oxen drawn wooden plow. They are mostly harvested by sickle, threshed by treading and the grain is cleaned by winnowing. The only change that has been introduced was the introduction of the high yielding seed and the use of the proper kind and correct amount of chemical fertilizer, so that the varieties could express their high yield potential and increase the per acre food produced and in the process improve the standard of living of the small farmer. The use of the Mexican wheats in many countries under rainfed conditions has also been highly successful but because of limitations of rainfall or uncertainties

of rainfall distribution during the growing season lower levels of fertilizer application are used with correspondingly lower levels of grain yield.

The so-called green revolution never proclaimed it would correct all the social and economic ills of the world that had accumulated from the time of Adam and Eve up to 1972. The fact remains, however, that it did greatly increase food production in many nations and by so doing tried to buy time to hold off the population monster until population growth can be slowed to reasonable levels, which will hopefully provide adequate food and a reasonable standard of living to all who are born into this world. It is the fault of the economic and political policy makers if the benefits of the green revolution have not been equitably distributed. Laws, taxes, etc. can be imposed if they exist or enacted if they are not in existence to correct these abuses.

To accuse the research team which produced the high yielding varieties and cultural practices which have led to greatly increase production of food grains both in Mexico and elsewhere of being responsible for inequitable distribution of benefits is both unfair and preposterous. Nevertheless, this is what the authoress has done.

The following quotation from Dr. C. P. Snow's publication "The Two Cultures" summarizes much better than I am able to do my feeling on the perspective put forward throughout this manuscript. I quote: "It is all very well for one as a personal choice to reject industrialization, do a modern Walden if you like, if you go without

much food, see most of your children die in infancy, despise the comforts of literacy, accept 20 years off your life; then I respect you for the strength of your esthetic revulsion, but I do not respect you in the slightest, if even passively you try to impose the same choice on others, who are now free to choose; in fact, we know what their choice will be, for with singular unanimity, in any country where they have had the choice, and the chance, the poor have walked off the land into the factories, as fast as the factories can take them." In fact, science and technology are the only means we have at present to provide the additional capital and know how to alleviate hunger and forestall briefly the relentless advance of the population monster.

The authoress has added confusion rather than enlightenment to these complex issues. Despite all of her generous criticism, she has not added one concrete feasible proposal to increase food production nor to minimize the inequities of benefits that accrue from research. She erroneously blames research scientists instead of government policy makers and officials for lack of proper decisions which would achieve more equitable distribution from the benefits of the green revolution.

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