DURUM RESEARCH POSSIBILITIES

by Norman E. Borlaug, Director, Inter-American Wheat Improvement Project, The Rockefeller Foundation, at the Wheat Quality Conference, Minneapolis, Minnesota

Norman E. Borlaug

I SPEAK as a member of a team of scientists which has been actively engaged in wheat improvement in Mexico for 18 years. The area of operation has broadened beyond Mexico in recent years, as the Inter-American Wheat Improvement Program, sponsored by The Rockefeller Foundation, has developed. The cooperation of the Mexican Ministry of Agriculture and of my associates, Dr. Ignacio Narvaez and Dr. Jacobo Ortega, has made possible rapid progress in durum wheat improvement in the past several years.

My comments on durum are made on a broad geographical basis, not just from the point of view of one of the largest durum producing areas of the world—the United States and Canada. I am also using the term "durum" generally, not only **Triticum durum**, but the related species, including **Triticum polonicum.** World durum statistics, especially from the Middle East, do not reflect the different classes of wheat produced. It is difficult to separate common wheat production from durum in some countries. The data at best are sketchy except when they refer to durum production in the Americas—the United States, Canada and Argentina.

Increasing Demands

Demands for durum have been increasing, especially in southern Europe, in the last 20 years. I am convinced that the whole durum industry is about to be revolutionized, and it will be done by a number of agronomic changes affecting durum wheat production. With the exception of durum grown in Mexico and Chile, very little durum is grown under irrigation throughout the world. It has been grown largely under dryland conditions because of its ability to resist drought better than any other wheat. In the Near and Middle East, durum will produce something under conditions where soil fertility is so depleted that other wheats will produce little or nothing.

What are the negative factors that influence durum production? When durum production is intensified, excessive height and resultant lodging of the plant is a definite limiting factor. Often this is the main obstacle to increasing durum production in many parts of the world. Durum most likely would be grown in other irrigated areas of the world if it had shorter straw. The extreme susceptibility of durum wheats to stripe rust has also limited production in many parts of the world. With few exceptions, durum wheats under most conditions are extremely susceptible to stripe rust, **Puccinia glumarum.** This will have to be corrected if the pattern of durum production is to be changed. Another important factor limiting durum production is susceptibility to frost. Durums in the Americas are spring durums. There is no need, however, for them to be spring durums. Long ago, with an intensified research program, winter durums could nave been produced. This would change the pattern of world production greatly. This is theoretically and practically possible.

Winter Durums

Winter durums exist today, if we refer only to growth habit, in the durum populations of Iran and Turkey. These have been studied in recent years and many pure strains developed. Despite the fact that they have winter habit, they are not resistant to frost. No one has tried to increase the frost resistance of durum, which we feel can be accomplished.

Late maturity is a serious factor in wheat breeding. It is increasingly clear that wheat, which is early under one set of conditions, is late under others. Length of day response, especially, appears simply inherited and may involve no more than one gene in many cases. I am under the general impression that if you move one gene—take it off Selkirk, take it off Thatcher—you will have an entirely different wheat from the standpoint of maturity. Many lines from Canada, with Selkirk and Thatcher backgrounds, were planted the first part of October in Mexico. With these sister lines growing in adjacent rows, one line heads the 10th of December, another the 10th of February, as usual for the Selkirk or Thatcher parents. This is a five and a half week difference. If one is to revolutionize durum production in other areas of the world, much more earliness must be incorporated. This earliness exists in some durum wheats, especially Indian durums, and it can be transferred very easily from bread wheats.

Improving Yields

Durum wheats, as we know them throughout the world, have been generally outyielded by bread wheats. There is an obvious reason. The amount of scientific effort that has gone into durum breeding, with the exception of the North Dakota and Canada durum programs, has been very small in proportion to the effort made with bread wheats. There is great potential for substantially increasing durum yields on a world basis.

When we began working on dwarf bread wheat varieties in the Mexican wheat program, two original crosses were made on the durums. Although at that time we were not convinced that dwarf wheats were going to be popular, we worked with them intensely. In 1959 an intensive durum program was begun. We were by then convinced that dwarfs had a place in the program. Now some of the first dwarf durum lines are in yield tests. We have continued to backcross them and to make converging duplicate crosses to correct some deficiencies. The dwarf durums now appear extremely promising. Over the last two years we have sent bulk F2 seed samples to collaborators in many parts of the world for testing. Reports have come back from many countries, with considerable enthusiasm for these dwarf durum wheats. Many people have been able to select promising strains from these bulk populations which may serve their areas of the world.

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We have had many inquiries about the possibility of setting up an International Durum Yield Trial, including the Mexican dwarfs, United States standard varieties, and the ones from Canada and Argentina. We are planning to do this for the first time this year.

It looks as if we may have gained something from this breeding program in increasing stripe rust resistance. At the same time we incorporated dwarfness, we also added a certain amount of stripe rust resistance. A higher degree of resistance is needed, however, and this is being explored at the present time.

We are interested in the prospect of winter growth habit durums for many countries, although they would not be used in Mexico. We have a program underway to cross the best Mexican durums with French winter wheats to increase the level of stripe rust resistance and also to convert these durums to a winter growth habit, and give them a certain amount of cold tolerance. Before a true winter durum can be produced, I believe it will be necessary to go through several cycles of varieties, step by step, adding dwarfness, stripe rust resistance, winter habit and frost resistance. This seems feasible and I believe it can be accomplished reasonably fast. Some lines are well along the way toward this objective.

Help the Scientist

I have had an unusual opportunity to observe the young group of Mexican scientists develop and mature. For what they have produced with lack of facilities, I would place them above any other group of young scientists in the world working on overall problems in wheat. The problems that are to be solved in food production around the world should get our consideration. There is nothing more disheartening than to see young scientists come back from United States, Canadian, and European graduate schools with a narrow, specialized viewpoint. If this is an age of specialists, it is not good for the countries that need bread. A specialist needs a broad point of view to understand that principles are more important than details. This is so important that it behooves each and every one of us to try to do something constructive toward a solution.

Crop Declared Good

The 1963-64 crop of durum wheat was pronounced "one of the best in the past ten years" by a leading authority.

Joseph S. La Rosa, senior vice president of V. La Rosa & Sons, Brooklyn, largest producers of spaghetti, macaroni and egg noodles in the U. S., said that samples of semolina, the yellow heart or middlings from durum wheat, showed excellent color and higher protein than usual.

Mr. La Rosa recently completed an inspection tour of major Mid-West durum mills with the company's director of quality control, Paul F. Russell. The new semolina already is being processed in all six La Rosa factories, after meeting rigid specifications for color, protein, ash, vitamin analysis and various other checks.

The Egg Picture

A warm, dry, Indian Summer was beneficial to egg production, and the egg picture remained relatively stable. Prospects are that egg supplies and prices for the remainder of 1963 will range close to those of the year earlier. The current large fall chick hatch could mean a few more eggs next spring. There is a higher percentage of old hens in the laying flock than last year, and the heavier culling should take place. During 1963 farmers are raising the fewest chickens for laying flock replacements since records began in 1909.

Whites Are Firm

Both egg whites and albumen supplies remained limited. Egg yolk represented an excellent value at a lower level than whole eggs at the end of October. The remarkable thing about egg yolk pricing in 1963 has been the narrow range in which yolk has fluctuated while albumen and whole egg prices have traded in a much wider range during the year.

Processing Down

Breaking activity continued on a limited part-time basis. Production of liquid egg and liquid egg products (ingredients added) during September was 30,718,000 pounds—five per cent less than in September, 1962, according to the Crop Reporting Board. The quantity used for freezing was larger than in September last year. However, the quantities used for immediate consumption and drying were smaller.

Liquid egg used for immediate consumption was 3,965,000 pounds, as compared with 4,507,000 in September last year. Liquid egg frozen totaled 18,129,000 pounds—up one per cent from September, 1962. Quantities used for drying were 8,624,000 pounds in September, 1963, and 9,712,000 pounds in September, 1962. Storage holdings at the end of September were 95,448,000 pounds, compared with 113,043,000 at the end of September, 1962 and were 25 per cent below the 1957-61 average of 127,646,000 pounds. Holdings decreased 10 million pounds during the month, compared with a decrease of seven million pounds in September, 1962, and the average decrease of 15 million pounds.

Egg solids production during September totaled 2,548,000 pounds, consisting of 1,230,000 pounds of whole and blend egg solids, 526,000 pounds of albumen solids, and 792,000 pounds of yolk solids. In September last year production was 1,006,000 pounds of whole and blend solids, 686,000 pounds of albumen solids, and 880,000 pounds of yolk solids.

Science Takes Over the Henhouse

Improving on nature is at the heart of modern agriculture. Recently Business Week reported on the experience of Heisdorf & Nelson Farms, Inc., of Kirkland, Washington, which applies a startling amount of science to the breeding of poultry for sale in a large part of the world.

In 1946, their first year in business, they produced only 52,000 chicks; in 1950, 500,000 chicks; in 1955, about 5,300,000, plus the output of franchised hatcheries (franchising began in 1953).

Figures are no longer given separately, but H & N's own hatcheries and those of franchise holders last year sold 90,000,000 chicks, and this year expect to exceed 100,000,000. H & N has 130 franchises active in North America, and between 60 and 70 hatcheries are producing in Asia, South America, and Europe. Gross sales top $3.000,000 a year.

Poultry is no longer a backyard sideline. A farmer used to have 200 or 300 laying hens of no particular breeding ,just the best he could buy locally. Fifteen years ago a good hen might produce 190 eggs a year; with scientific breeding this has been boosted to 280 or 290.

Business of Specialists

Egg production is more and more a major business of specialists; a flock of 10,000 to 20,000 laying hens is only medium sized today, and a few poultry farms go over 500,000.

With that kind of investment, poultrymen look for the best scientifically bred stock they can find. This in turn dictates concentration in the poultry breeding business.

There used to be hundreds of small breeders all around the country, but genetics requires special skills that a small outfit can hardly hire, let alone pay for. So the business moves in the hands of fewer, larger companies that can do the job scientifically on a big scale.

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