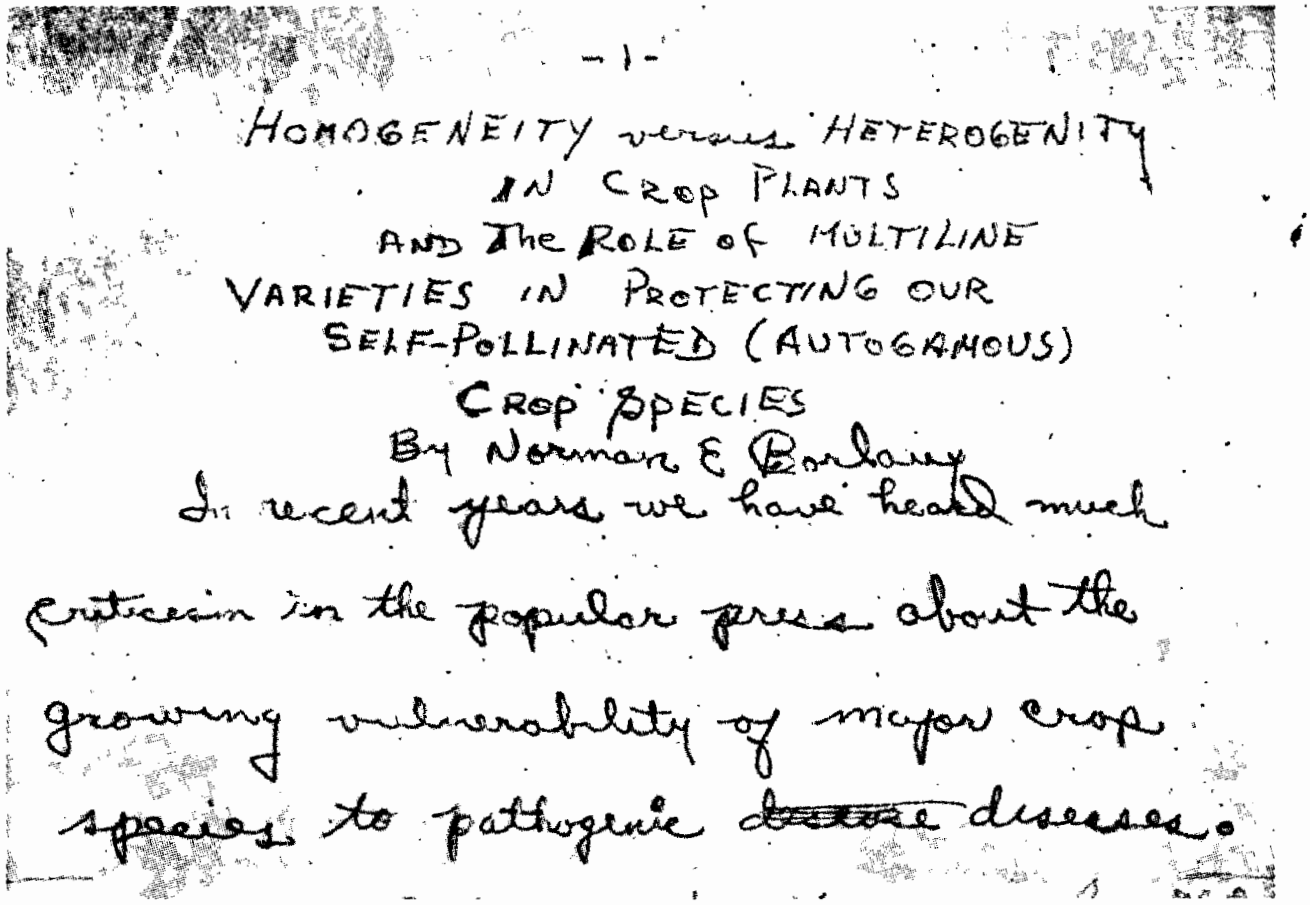
Dr. Borlaug's Views on Multilines



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HOMOGENEITY versus HETEROGENITY
IN CROP PLANTS
AND THE ROLE OF MULTILINE
VARIETIES IN PROTECTING OUR
SELF-POLLINATED (AUTOGAMOUS)
CROP SPECIES
By Norman E Borlaug

In recent years we have heard much criticism in the popular press about the growing vulnerability of major crop species to pathogenic ~~disease~~ diseases.

[Surrounded by autograph hunters and otherwise heavily pre-occupied with crowded programmes of the 5th International Wheat Genetics Symposium and multi-lines seminar, Dr. Norman E. Borlaug was good enough to give a special brief to the Chief Editor, Seeds and Farms, on 21st February, 1978 at the IARI Auditorium, Pusa, New Delhi.

Basing his impressions on the deliberations taking place, and in essence keeping the good of mankind in view, Dr. Borlaug gave out his views instantly on a piece of paper scribbling with lead pencil the thoughts that richly deserve to be written in golden letters.

Dr. R.G. Andersón, his colleague, quickly glanced through the scribbled notes, nodded in agreement with the views of the Nobel Laureate, and smiled in appreciation of Dr. Norman E. Borlaug's ingenuity, deep human touch and his ready willingness to accede to the request of the Chief Editor, Seeds & Farms, for an exclusive interview. Full text appears on the following pages.—Chief Editor]

WHEAT TO FIGHT HUNGER

In recent years we have heard much criticism in the popular press about the growing vulnerability of major crop species to pathogenic diseases. These criticism most often are leyelled at the use of the so-called monoculture of one or a few crop varieties over large geographic areas. Although there appears to be some justification for this criticism when current agricultural development is examined superficially, there are certain compensating factors which offset the apparent drift toward growing vast expanses of single crop varieties. In order to appreciate the complexities of this issue let us examine the changes that have occurred in our food production systems since the beginning of agriculture some 10 to 12,000 years ago.

At the outset we must recognise that crop production methods that were adequate 12,000 years ago when world population stood at 15 million would not have been adequate when the world population reached 2 billion as it did in 1930. or even less or when it reached 4 billion as it did in 1975.

Agricultural production systems and methods have by necessity been forced to evolve as human populations have grown and as food production requirements were increased enormously.

In 1966 Dr. Paul Mangelsdorf indicated that there is some evidence that indicates that during pre-historic and early historic times, 3000 species of plants have been used—either collected or grown—as food by man. Further, there is evidence that 150 of these species were cultivated on sufficient areas that they entered into commercial trade. Today our food supply in a large part is produced by only 15 plant species.

During the dawn of agriculture the food supply and the crops on which it was based was protected in part by a number of different interacting factors.

The small family plots were specially separated from one another, for then potentially good arable land was abundant. The landscape was a mosaic of cultivated plots, forests and grassland. Within the family plots, many different crop species were interplanted to increase the diversity of the food supply but also to reduce the risk of losing the entire crop from the disease or insect outbreak. Moreover, cropping intensity in early times was low. Plants were widely spaced, and the populations of the self-pollinated crop species were mixed (land races) made up of a mixture of different types. Both of these factors tended to reduce the danger of losses from epidemic outbreaks.

As villages and later cities, with a large and growing demand for food evolved, it was necessary to gradually increase the cultivated area and intensify the cultivation of the family farm to meet this demand. These events in themselves tended to increase the opportunities for the development of epidemics.

The next events that influenced protection or susceptibility to attack from pathogens was selection of "superior" types from the "land races", first by unnamed keenly observant farmers, and in the period from the 1880's to 1920's by many scientists. By the 1920's—and continuing upto the present time—hybridization to combine two or more genes from different varieties into a new variety has been the principal approach. This was done to improve disease protection and it has become the standard procedure used to produce crop losses. The results have been very positive and have contributed to reducing crop losses in self-pollinated crop species. But the most destructive pathogens of wheat—the rusts—are shifty enemies. They mutate and/or hybridize to produce new races of the pathogen capable of attacking varieties that were formerly resistant to the races in existence in the region at the time a particular variety was developed and released.

It is a constant struggle to produce opportunely a series of new varieties with a broader spectrum of resistance and have them multiplied and distributed to the farmers before an epidemic caused by a new race of the pathogen causes disaster.

The development of the multiline concept of varietal improvement is an attempt to develop a large number of lines which look alike from the standpoint of the farmer and are sufficiently uniform to be accepted by the industrialist and consumer. These lines will posses different sources of resis-

An exclusive sketch of the Nobel Laureate drawn for Seeds & Farms by well-known Indian cartoonist, Mr. Ranga.

tance. The multiline variety distributed to farmers will be a mechanical mixture of 6 to 10 lines that carry resistance to the rust races in the large geographical area where the variety is to be grown. The component lines incorporated into the multiline variety at any point in time will be determined by monitoring the rust race population in the region. The multiline variety approach has great flexibility and can be modified as needed.

It is curious that multiline varieties of oats are being used extensively and successfully in the U.S.A., even though the concept was first developed using wheat as the crop species. Are oat breeders and oat pathologists more progressive in their crop than wheat breeders and wheat pathologists ?

There are also those who blame science and technology for all of our disease and insect losses. They imply that it is science and technology that has thrown nature out of balance thereby causing crop losses. They ignore the "book of fossil rocks" which clearly indicates that in geologic times there have been many shifts in nature provoked by Mother Nature herself—long before man took his first step on the planet Earth. These species that could not evolve fast enough to meet the shift caused by Mother Nature, perished and we know about them only from fossils.

We can't go back to the "good old days" before science and technology and produce the food required to feed 4 billion people.

To advocate this as some nostalgics are doing is both irresponsible and reckless unless these utopians have found some major humane way of reducing the current world population of 4 billion to a population of 2 billion. We simply do not have time to enjoy dreaming of the past; it may be enjoyable but certainly won't solve our many problems of today and won't mitigate human hunger and suffering.

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