Agriculture beyond 2000

By Ateeq Malik

WE have now entered into the third millennium by seeing the close of the most remarkable century in the history of agriculture i.e. the 20th century, particularly its latter half in which agriculture changed from a resource- and tradition-led enterprise to a science-based industry.

The change to a science-based agriculture has meant higher and more stable production and a better way of life for billions of people. The most important development had been our ability to produce continually larger harvests, ensuring food stability and security for a constantly growing world population. How did it happen and what did cause this phenomenal change? It was the "Green Revolution" which made all this possible.

The Green Revolution is the term used since about the 1960s to describe the effort to increase and diversify crop yields in developing countries. Norman E. Borlaug, so far the only Noble laureate in the field of agriculture,—an American, considered to be the founder of the Green Revolution—stressed the need to abandon local and traditional strains of plants and breeds of animals in favour of new strains and breeds, and conducted research to enable new procedures to be adapted to local conditions and hence introduced chemical fertilisers.

Although human numbers have doubled since 1960, reaching 6 billion in 1999, food production has outpaced population, chiefly as a result of the development and use of improved plant varieties, a seven-fold increase in the nitrogenous fertilisers, a doubling of irrigated area, more vation in the country has not decreased but at least for the last 10 years it is almost the same i.e. 21 million hectare. And with the population explosion, it has also posed a serious threat to our economy, as this cultivated area is very difficult to increase because of water limitations. We should think over this grave situation and make serious efforts to face the challenge.

Keeping in mind the probable population explosion, Norman Borlaug, in his Nobel prize acceptance speech in 1970 stated: "The Green Revolution has won the temporary success in man's war against hunger and deprivation; it has given man a breathing space—if fully implemented, the revolution can provide sufficient food for sustenance during the next three decades. But the frightening power of human reproduction must also be curbed; otherwise, the success of the Green Revolution will be ephemeral only". And in 1992, Borlaug said that "today, the world leaders have wasted 22 years during which they did not even discuss the matter. With only a few years left before it will be too late, I warn them: there will not be another Green Revolution".

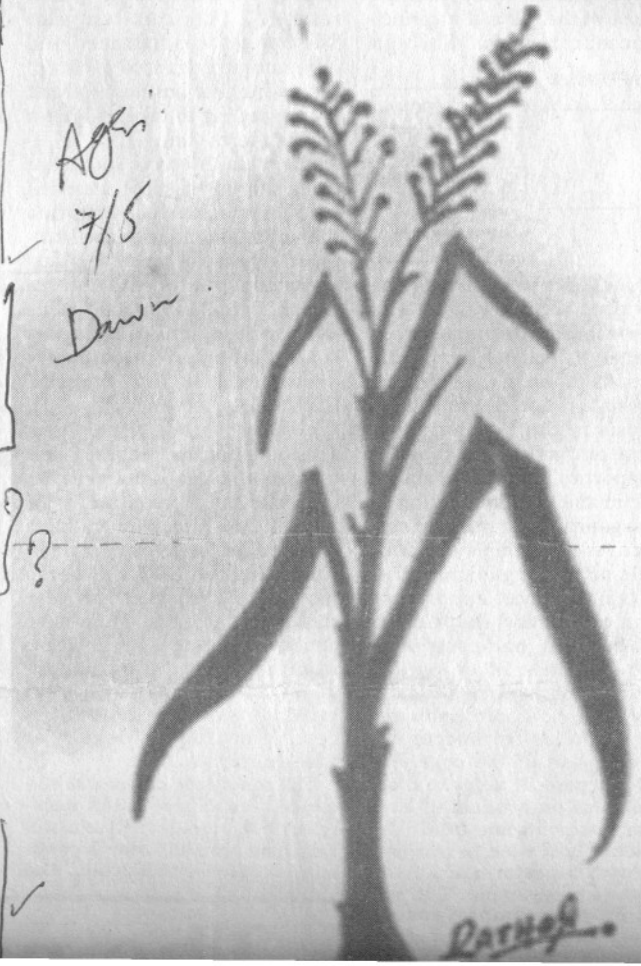
Now here the question arises that can food production keep pace with population growth in the next half century or how much further the Green Revolution can go?

If we take the example of Pakistan it can be said that we are still at the onset of Green Revolution, especially from the fertiliser point of view because majority of the farmers is still unaware of the proper fertiliser usage. We are still far off from the potential of our agricultural produce. We have achieved 2.2 tons in wheat, 2.8 tons in rice, 1.3 tons in maize and 50 tons in sugarcane per hectare against the potential of 6.4 tons in wheat, 6.8 tons in rice, 6.9 tons in maize and fertilisers/nutrients externally. According to an Australian research, "more than two million tons of nutrients are removed from our agricultural soils each year in farm produce alone".

(ii) Livestock, municipal and industrial wastes: These contain enormous quantities of all the nutrients in the shape of farm yard manures, sewage, press mud, etc. Their usage in agricultural soils is very helpful.

(iii) Biological nitrogen fixation: The biologically fixed nitrogen is derived upto 100-180 million metric tons per year, its production for good crop harvest irrespective of quantity. This is the major cause of our very low yields as compared to the production levels achieved at the experimental stations in our country.

In Pakistan the current use of straight fertilisers which ultimately provide N, P and K to the soil is 110 kg/hectare as compared to 300-600 kg/hectare in Western Europe and 300-350 kg/hectare in China and Egypt. In our country where the organic matter is already less than 1 per cent in the soils, the use of N and P is between 1:3.35-4.03 as com-



using this storage water we can ultimately increase the cropping intensity, and the whole-irrigated area can be double-cropped which is now just 30-40 per cent. Lining of the water courses can also overcome the current enormous losses. To avoid a huge expense on lining at farmer's land, geomembrane-PVC sheet can be used to reduce water losses. Public and private tubewells should be encouraged to increase the water availability. Proper mulching can also conserve moisture to some extent.

In view of the unbalanced fertiliser usage the need for the use of balanced fertiliser is now well recognized. A leading private sector fertiliser company has accordingly decided to put up an NPK blending plant at Karachi to meet the demand of NPK fertilisers. These fertilisers will be crop-specific and will provide the farmers with complete recipe for basal fertiliser application. The NPK will be fortified with other micro and macro nutrients required by different crops.

This fertiliser would keep soils fertile by replacing the already replenished nutrients by the produce and would definitely flourish the idea of adequate and balanced fertilisation. This fertiliser would also improve the water use efficiency. According to Dr Mike Stewart, Great Plains Director, Potash and Phosphate Institute, crop water use efficiency is improved with adequate and balanced fertility because more yields can be produced with the same amount of water. A well-fed crop produces a healthier and more extensive root system i.e. capable of extracting water and nutrients more efficiently than a nutrient deficient crop. According to research, nitrogen fertilisation alone increased water use efficiency by 90 per cent but where N and P fertilisation was balanced, water use efficiency was increased by over 200 per cent. Good fertility manage-

the nitrogenous fertilisers, a doubling of irrigated area, more effective control of insects and diseases, improved strains of livestock and poultry, and wider use of nutritionally balanced feeds.

In Pakistan also, the Green Revolution has resulted in tremendous yield increases. In case of wheat, production has gone up from 3.9 million metric tons to 21 million metric tons. Rice has progressed from 1.3 million metric tons to 5.1 million metric tons. Maize production also shot up from 0.7 million metric tons to 1.35 million metric tons and sugarcane production from 22 million metric tons to 46.3 million metric tons.

Now with the beginning of the new millennium the situation has changed a bit and it is really a challenging one. The land has become a scarce resource. Since the last decade of the 20th century. farming in one area for few years and in other for some time has become a dream. According to a research, the worldwide per capita base for agricultural production has declined dramatically over the past few decades and is expected to continue to decrease e.g. it is estimated that by the year 2025 the land in production per person will be 56 per cent less than it was in 1965. This continued reduction would ultimately demand further increase in yield.

It is the case here in Pakistan. Although total area under cultivation and, above all, to see a prosperous Pakistan, we should follow the "best management practices" in all the spheres of farming. It includes good land levelling, soil and water analysis, timely sowing of crops, adequate and balanced fertilisation, good irrigation management, good crop rotation according to agri-ecological conditions, better storage of the produce, etc.

tons in rice, 6.9 tons in maize and 166 tons in sugarcane per hectare, respectively.

Now to compete with the water shortage, increasing population, threat for decreasing land for cul-

All these practices are indispensable for better produce but chemical fertilisers and their usage is much more important as they act as the instant energisers and the ultimate growth enhancer for the plants. As somebody has stated that "there is no life without plant and there is no plant without nutrients".

Sources of plant nutrients: The following sources provide plant nutrients:-

(i) Nutrients from soils: Nature has provided the soil with all the essential nutrients and made it fertile but because of intensive farming, soil becomes deficient in nutrients as these are taken away from the soil by the farm produce. So, for their replacement and maintaining the fertility of soils we have to put mineral being perhaps more than the chemical fertilisers per annum. For this, farmers must grow leguminous or green manuring crops for their soil's robustness.

(iv) Mineral fertilisers: In Pakistan, production of mineral fertiliser is not meeting the demand and in the near future the situation seems to remain the same. So, we should utilise the presently available fertiliser quantity in an adequate and balanced manner to keep the soil in a good condition. There is, at present, no alternative to mineral fertilisers on a regional or global scale if food supply is to be ensured.

Two major problems of Pakistan: Agriculture in our country faces two major problems. These are: unbalanced fertiliser usage and water shortage.

Fertiliser: It is unfortunate that in our country very few people, may be 1-2 per cent, follow the recommended doses of fertiliser for the crops. Most farmers still believe that fertiliser is nothing but urea or nitrogen and that they don't require any other fertiliser: be it macro (P,K), secondary (Ca, Mg, S), or micro (Zn, Cu, Co, B, Mo, Mn, etc). This injudicious use of nutrients is actually mining all the other nutrients from the soil which are needed pared to the recommended quantity of 1:2-2.5. It means if a farmer is using 1 kg of P, he should use 2 or 2.5 kg of N for a balanced fertility status in the soil. The use of the potassic fertilisers is very nominal here, which has also caused its deficiency in some of our soils. This nutrient is important for all the crops, specially banana, sugarcane, mango, potato, etc.

The prevailing irrigation water inadequacy can check the area under cultivation, proper crop growth and ultimately the production. Approximately 90 per cent of the agricultural production comes from irrigated land supplies. Delivery efficiency from the canal head to the crop root zone is as low as 35-40 per cent i.e. out of 93 maf water which comes from the rivers into the surface irrigation system, only 35-40 maf reaches the crop root zone. The remaining 56 maf is lost to water course losses, canal seepage and breaches, etc. This is really a very huge loss. We definitely require proper management of irrigation water. Low rainfall during this year has further intensified the situation.

Secondly, we have to develop new reservoirs for storage of surplus water during kharif seasons. By ment also results in reduced potential for erosion by producing a more healthier and vigorous crop that closes the canopy and covers the soil more rapidly. In conservation tillage this generally results in more surface residue and reduced potential for erosion and nutrient run-off into surface water. More biomass is produced with adequate and balanced fertilisation.

To conclude it can be stated that this adequate and balanced fertilisation practice, if properly understood and adopted, will definitely prolong the period of Green Revolution, food production can keep pace, if not outpace, with the existing population growth in the next half century. This adequate and balanced fertilisation has the ability to completely overcome Pakistani soils fertility problem and cope with the irrigation problem in agricultural areas pretty well.

With the following comments I will sum up this article;

"Socolow (1999) remarked that agricultural biotechnology is the nuclear power of food, and mineral fertiliser is its fossil fuel. The analogy is valid upto a point, but the crucial difference is that nuclear energy can ultimately replace fossil fuel, but biotechnology may not replace mineral fertiliser, but it can improve fertilisers use efficiency".