

Book Review

"Science and Agricultural Production" by Ingrid Palmer. United Nations Research Institute for Social Development, Geneva, 1972.

"Science and Agricultural Production" provides a comprehensive coverage of the factors of production underlying the Green Revolution, and discusses in detail the constraints that inhibit their use and the specific implications of such constraints for a social, economic and ecological analysis for less developed countries.

Ingrid Palmer considers fertilizer usage to be the principal factor underlying the Green Revolution. On the basis of a fitted rank correlation between fertilizer usage and the yields of rice and wheat for various countries, the author concludes that, given adequate soil moisture, agricultural productivity can be greatly increased with improvements in the level of fertilizer application alone, irrespective of the varieties grown. The significance of the High Yielding Varieties (HYVs) begins to appear only when the fertilizer application is about 10 times the present actual dosage. Three characteristics of the HYVs, the leaf erectness, the high tillering rate, and the leaf area, have been discussed as the chief activators of nutrient uptake associated with a high conversion rate of fertilizer to grain formation, through the process of photosynthesis.

The ultimate response of seeds to fertilizer application and the use of HYVs, varies with the location, depending on environmental conditions (such as physical factors as climate, soil, solar radiation, water, pests and diseases, plant breeding research, and seed production) and the cultivators' response to new cultivation methods.

Palmer assesses the impact of individual constraints on crop yields. Climate affects yields through temperature changes experienced during the growing cycle, the pattern of solar radiation, the incidence of rainfall, and the interaction of these three. Above-average temperatures during the tillering stage, (the overhead) cloudiness during the grain formation stage, and the incidence of unpredictable rains, all adversely affect the yield potential of a plant.

Soil characteristics, such as type, composition and structure, and seasonal features, determine the availability of nutrients to plants. Clay soils are impervious not only to water but also to plant nutrients. Excessively leached soils lose some of the nutrients to the plant root zones. Water-logged soils are injurious to plant growth and may not be conducive to a profitable application of fertilizers. Low temperatures inhibit nitrogen and phosphorus uptake. On the basis of such considerations, the author draws three inferences: (1) on abnormal soils, the law of diminishing returns begins to operate rather early; (2) although the visible response of HYVs to doses of nitrogen is substantially positive in first few years, in the long term, yields decline if the soil is depleted of phosphorus and potassium; and (3) inappropriate applications of fertilizers can result in low yields and may even cause toxicity of soil.

The author believes that the HYVs respond strongly to fertilizers when solar radiation is at a maximum during the ripening period. However, since the HYVs must have adequate and well regulated supplies of water to make full use of fertilizers, they cannot be exploited in situations where the timing and amount of rain are unpredictable. Further, since cloudiness reduces solar radiation, the magnitude of response to fertilizers will vary with location.

The author recognizes that substantial yield losses may occur on account of pests and diseases, a 20 per cent loss in the potential crop being common and considers the HYVs to be particularly vulnerable to pests and diseases for the following reasons: (1) There is the well known problem of loss of heterogeneity of plant types in one district, (2) the common ingredients of the HYVs attract pests and diseases, (3) excess use of fertilizers of HYVs gives rise to higher incidence of diseases, and (4) multiple cropping provides the insects with hibernating places and regular food. Current plant protection measures are inadequate and too expensive to help recover losses.

In view of these constraints, the emphasis of research has shifted towards evolving varieties (itself a constraint) more suited to the environment. Individual country efforts, despite large expenditure on plant breeding, have met with little success in the past. It is recommended that efforts in this regard be made at an international level to supplement national programmes.

Finally, the author feels that the imposition of new husbandry practices with untested ecological and biological outcomes cause the farmer to lose personal control over his own environment. Should things go wrong and the farmer be required to use more pesticides and herbicides, he will have to bear the resulting financial burden and not those who planned on his behalf. The author believes that it would have been much better if the farmers had been trained in increased use of fertilizers and pesticides before they started growing the HYVs.

Though Ingrid Palmer has presented a comprehensive analysis, it appears that the casual empirical evidence of the book is not sufficient to support such conclusions as that, (1) HYVs have failed to respond to meagre fertilizer inputs in most of the South and Southeast Asian countries, and that (2) HYVs' introduction has been a cause of inconvenience and uneasiness to the farming communities. There is enough evidence to show that the cereal production in many of these countries has experienced a manifold increase with the introduction of the HYVs. Before 1960-61, total wheat production in West Pakistan was only 3.8 million tons. In 1964-65 it reached a maximum of 4.5 million tons. Mexican varieties of wheat were introduced in 1965-66 for the first time. Only 16 per cent of the total wheat acreage used the Mexican varieties during 1967-68, but the total wheat production in that year was 6.3 million tons. Such a sharp rise despite meagre use of fertilizers, can only be attributed to the introduction of HYVs.

Since the HYVs were a new experience some uneasiness in the farming was inevitable. Nevertheless the introduction of HYVs has accelerated the renunciation of some of the centuries old modes of cultivation by the farmers.