

formed by fission of heavy elements fails to account for the presence of the p-process nuclides and has never been taken seriously.

Examples of some sentences that suffer from 'language problem':

(i) Page 79, para (f): 'The energy discontinuity is around 2 MeV, i.e. about 25% of mean binding energy in β disintegrations in the neighbourhood of magic numbers.'

(ii) Page 269, second para, last sentence: 'Since then ever so many reactors have been functioning in many countries at very many times higher power levels, extending upto 10^9 W.'

(iii) Page 227, first para, second sentence: 'This is in spite of its advantages in respect of the raw materials needed being very much cheaper and the process involving far less of radiation hazard as none of the by-products is radioactive which is not wholly contained.'

(iv) Page 290, third para: 'Let us note that reactor or no reactor, mankind has been exposed from the beginning of time to nuclear radiations of cosmic and terrestrial origin, besides those due to ^{40}K present in all rocks and the seas and in our very body, besides ^{14}C .'

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Wheat Revolution – A Dialogue. M. S. Swaminathan (ed.). Macmillan India Ltd., P.B. No. 7092, Daryaganj, New Delhi 110 002. 1993. 164 pp. Price: Rs 224.

This book contains the history of growth of wheat production in India, leading the country not only to self-sufficiency but to food security. Revolutions are a radical change in the constitution of a country after revolt, which are often violent, and after a change in government dissipate over time. 'Wheat revolution', however, saved the country from going through a revolution as was predicted by some writers from developed countries. Has the 'Wheat revolution' dissipated as pointed out by Mr.

Shivaraman? Therefore, recapitulations of events, in the form of a dialogue by major actors which led to 'Wheat revolution' synonymous with green revolution was an appropriate and laudable effort. M. S. Swaminathan, who organized the dialogue at M. S. Swaminathan Foundation, and had the central role in it, is to be commended for bringing out this book for the benefit of present and future generations.

Several questions have been raised in the recent past about 'Wheat revolution/Green revolution' relating to leadership, scientific basis and policy actions. The book provides answers, to some extent, to these questions through group discussion on (a) Package of technology, including new varieties, agronomic practices and post harvest handling, (b) Package of services, including the timely supply of seeds, fertilizer, water and credit and (c) Package of public policies, assured and remunerative marketing, building of grain reserves, etc.

It is obvious from the discussions that till 1963 there was no technology when the seeds of varieties having Norin dwarf traits in spring wheat background were obtained in sufficient quality from Borlaug to plant experiments at IARI (Indian Agricultural Research Institute, New Delhi). Since this material was found promising at Delhi, Ludhiana and Pantnagar, a decision was taken to put demonstrations in farmers fields, thus by-passing the usual norms of coordinated trials and extension programmes. This speaks of the confidence of scientists in adopting an alternate strategy. A large amount of credit goes to decision makers, particularly C. Subramaniam who agreed for the import of 18000 tonnes of wheat seed from Mexico of the varieties which were already identified at Delhi, Ludhiana and Pantnagar. This material was planted in Punjab (then Punjab and Haryana) and Western UP where the climate was suitable for wheat production and supported by assured water supply, and enterprising farmers. Within three years production jumped from 12 to 17 million tonnes from 1965 to 1968. There would have not been so much success if the decision to purchase red wheat by government at the same price as desi wheat was not taken because the red grain of new varieties did not fetch good price in

open market. Even today the amber varieties derived from Mexican dwarfs such as Kalyansona, HD2329, HD2285 and others fetch less price than desi varieties such as C306, NP824, K68 and others. Thus the purchase price was an important decision for encouraging wheat production. Having got success with production, it was necessary to develop varieties with amber grain colour as against the red colour and chapati quality acceptable to consumer. Interestingly, a population S227 which came from Mexico provided several amber grain selections such as S227, S307, and S308. The selection S227 was named as Kalyansona which had performed very well at Delhi, Ludhiana and Pantnagar. Kalyansona was an acceptable variety for grain colour but still required improvement for chapati quality. Later on several crosses using Indian varieties and new dwarf varieties were made and varieties with better quality were developed. The technology with reference to irrigation and fertilizer application was developed. It so happened that 1964 and 1965 had deficient monsoon rains, and possibly a kharif crop preceded wheat crop, therefore, six irrigations appeared to produce the maximum yield. At that time not much attention was paid to soil-moisture profile and winter rains. However, the recommendation of five to six irrigations was extensively popularized and made sacrosanct. This led to over-irrigation and with considerable difficulty, now, the reduced number of irrigations are an acceptable recommendation. It also took time to fix an economic dose of fertilizers which is dependent on location, variety, irrigation, etc. The most fortunate aspect of wheat production in India is that we have no insect pest problem and the Indian scientists from the time of K. C. Mehta and B. P. Pal have been experts in breeding for rust resistance.

The 'package of services' includes the recommended seed for a given location, irrigation, fertilizer availability, and any other input such as machinery or energy which now have become important. In the initial phase 1966 to 1968, the target area was Punjab (Punjab and Haryana) and West UP where most of these services were available. However, there was a coordinated effort among scientists, bureaucrats, politicians and above all

the farmers. The need of the hour was to increase production and hence everyone made his or her contribution to this national goal. The 'dialogue' brings out clearly that the scientific awareness, vision and intuitions of M. S. Swaminathan, combined with clarity and commitment to national objectives of C. Subramaniam were the major contributors to 'wheat revolution'. The late B. P. Pal gave all the encouragement to scientists and the late V. S. Mathur bred a number of varieties which even today

are the dominant varieties. The country owes them gratitude for their accomplishments. There was, however, a significant role of the Indian Agricultural Research Institute, New Delhi, Punjab Agricultural University, Ludhiana and G. B. Pant University of Agricultural Sciences & Technology, and their scientists who worked together to make a success of dwarf wheats in India. Norman Borlaug through his material and visits to encourage scientists played a pivotal role in this programme.

There are some activists in the country who have been critical for wheat/green revolution for various reasons. They are entitled to do so because they have enough food available to them and have rarely experienced the scarcity of food.

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