Table 1.

Category of wasteland useful for groundwater	Area (sq. km)	Percentage of country area
Gullied and ravine land	20,553	0.65
Land with or without scrub	194,014	6.13
Degraded notified forest land	140,652	4.44
Degraded pasture	25,979	0.82
Degraded land under plantation	5,828	0.18
Sands – inland/coastal	50,022	1.58
Barren rocky/stony waste/sheet rock area	64,585	2.04
Waterlogged and marshy land	16,568	0.52
Total	518,201	17.2

Source: 1 : 50,000 scale wasteland maps prepared from Landsat Thematic Mapper/IRS LISS II/III data.

(NRSA) provide an alternative classification of land use/land cover. The NRSA has two sets of estimates of wastelands in India using data based on these techniques. The first uses Landsat data on a 1 : 1 million scale of mapping. The second uses LISS-I and LISS-II data with a 1 : 250,000 mapping. These two sets give differing estimates of wastelands. The second estimate puts wastelands at 75.53 m ha; the first at 53.3 m ha. Both estimates yield a much lower figure for wastelands than the NWDB exercise'.

We use LISS II/III data to compile Table 1. Thus useful wasteland for the extraction of groundwater amounts to 518,201 sq. km (51.8 m ha) or 17% of the country area. This is substantial.

Providentially, the impoverished wasteland has unpolluted aquifers under it. Leaving out saline, mined land, shifting cultivation land and glacial and mountainous segments, we still have 17% of the country area left for water resourcing. This has not yet been noticed. We would like to forest and preserve these lands as water sanctuaries. They need to be notified as water sanctuaries with strict laws prohibiting agriculture or industry on them. Any contamination of these, the only good groundwater sources left, would be unpardonable. There is no other choice, as there is no other source of good water.

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Soil nutrient management: Feast and famine approach vs life-cycle assessment approach

Agricultural production in India has increased largely due to the introduction of high-yielding cultivars and improved crop and soil management practices. Yet, there are concerns, in fact, qualms due to the growing needs of the ever-increasing population. The responsibility of finding ways to increase the production from the limited natural resources is heavy on our creativity. The current inequalities in the production of individual crops in different agroecological regions still baffle researchers. There are numerous factors which contribute to the failure in realizing the production potential of a crop. Discrepancies in the nutrient-supplying capacity of different soils can be due to the differences in their geochemical and soil biological factors; they are largely responsible for the failure in achieving higher productivity. Crop and soil-management practices are considered the key strategies to maximize the production potential of a crop at different locations. Among these practices, fertilizer application to crops is the most important. In order to avoid short supply or over use of fertilizers, it is always advised to apply fertilizers after testing the soil. The chemical fertilizers are generally applied at specific stages of crop growth, mostly at the time of planting or with the initial preparation of land, is popularly known as 'basal method'. There are different fertilizer recommendation schedules for different crops. The application of chemical fertilizers is largely from the understanding that soils do not have adequate levels of certain plant nutrients throughout the cycle of plant growth and at the required levels. But these recommendations appear to have limited applicability since they do not consider the requirement of crops, which differs depending on soil-biotic factors, and do not consider the nutrient requirement of crop plants throughout their growth cycle. The present soil nutrient-management approach may be referred to as the 'feast and famine approach', for the nutrition of crop plants. Application of fertilizers with one or two nutrients at specific stages of growth of crop plants in the mode of 'feast and famine approach', and expecting to maximize the crop productivity may not be enough. Like any other organism, plants demand nutrients daily, and at different levels during specific stages of their growth, depending on the environmental and biotic stresses. There are also problems related to the inefficient utilization of applied fertilizer. Certain cultivars have better nutrient-absorbing capacity, while there are reports about the agricultural produce lacking essential minerals such as iron and zinc. As soils are considered as 'living entities', there is an absolute necessity that nutrients are supplied to meet the requirements of other living organisms too. Soil microorganisms are known to decompose, degrade or immobilize the applied fertilizers and their activities add up to the demands of plant requirement for nutrients from both chemical and natural sources. Numerous reports are available on the losses of applied fertilizers, especially from nitrogenous and phosphatic fertilizers; these losses have a greater impact on the quality of the environment due to atmospheric and water pollution[1,2]. Thus, the present 'feast and famine approach' to plant nutrition has many disadvantages, especially by contributing harmful effects to the environment and will continue to show the inequalities in achieving yield potential of crops. There is a need to scientifically evaluate the soil fertilizer-management practices under the 'life-cycle assessment (LCA) approach'[3].

The systems approach which has components such as inventory analysis, impact analysis and improvement analysis, will help evaluate the environmental consequences of fertilizer application from 'cradle to grave'. The ultimate goals of the LCA approach include comparison of environmental performance of agricultural practices or products, and to make eco-efficient improvements in the system. The LCA requires a great deal of data[4] and is a decision-support tool. Sustainable development in agriculture requires this approach to use natural resources efficiently and to minimize the waste. Or else, the current 'feast and famine approach' to plant nutrition can only remind us about the action of that unknown butcher, who feeds his goat with water to its full stomach, so that he benefits from the increased weight. Global concerns on the environment strongly necessitate that agricultural management at the farm level is on the basic tenet of the LCA approach, in order to utilize the natural resources efficiently and to prevent environmental degradation.

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NEWS

MEETING REPORT

Pre-harvest sprouting in cereals: A global scenario*

In order to assess the progress in research towards understanding the physiology, genetics and molecular biology of pre-harvest sprouting in cereals, an international symposium is being organized every four years. Starting in 1975, ten such symposia have been already organized[1]. In this sequence, the 11th International Symposium on Pre-harvest Sprouting in Cereals was held recently in Argentina. About 54 delegates representing 12 countries attended the symposium.

Pre-harvest sprouting (PHS), i.e. precocious germination of grains in the ear following physiological maturity, leads to a reduction in grain functionality, grain yield and viability of seed, resulting into significant economic losses. The sporadic occurrence and complex biology of PHS is a major challenge faced by crop geneticists. The aim of the symposium was to discuss different aspects of the PHS phenomenon and the possibility of minimizing the incidence of its adversity. The key aspects that were discussed in the meeting included the following:

(i) Physiological, genetic–molecular and environmental control of dormancy in cereals. (ii) Physiology and molecular biology of the cereal grain post-germination growth. (iii) Physiology of deterioration in the sprouted grain.

Daryl Mares chaired the opening session and highlighted the importance of agronomic management for PHS/dormancy. Daniel J. Miralles (Argentina) underlined the problem of PHS in wheat and barley, particularly in the context of expansion of agriculture to the marginal areas of Argentina favouring sprouting. He also discussed empirical models available for some barley cultivars for predicting PHS risk. Hickey *et al.* (Australia) presented their findings on rapid screening for PHS-resistant grains.

The significant role of genotype and environment in determining the expression of seed dormancy and PHS was reiterated by Nyachiro (Canada) and Gualano and Benech-Arnold (Argentina). For instance, in malting barley grains, under high temperature conditions, air temperature is the key determinant of the dormancy release pattern during the final stage of grain-filling. Further, Gualano and Benech-Arnold reported a linear relationship between temperature in the 'sensitive window' and germination index after physiological maturity.

Chandler[2] (Australia) presented experimental results on the involvement of gibberellic acid (GA) and abscisic acid (ABA) in dormancy[2]. Using GA mutants of barley, they demonstrated that GA response is not required for germination, if dormancy has been lost but ABA is important in maintaining dormancy of barley grains. In sorghum, RT–PCR analysis showed that dormancy blocks the rise in GA levels, which may be partly due to strong ABA signalling in dormant grains. In barley, caryopsis protein ABAP1 regulates genes involved in germination (Rodriguez *et al.*).

Rathjen (Australia) presented results of the study on the movement of water in seeds using magnetic resonance micro-imaging and reported that neither the rate of increase in water content nor the distribution within dormant and non-dormant grains differed significantly. They em-

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