

guided by the law 'if' it happens in future.

The book is an elegant work about the new era that might come with this important discovery. It provides ample arguments that justify human cloning and suggests that the hue and cry against cloning is unnecessary. The book is well written and is worth reading.

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Value addition to Weather Data: Advisory Service to Farmers. V. Rajagopal and S. Naresh Kumar (eds). Central Plantation Crops Research Institute, Kasargod 671 124, India. 102 pp. Price: Rs 230.

Science is the foundation upon which the superstructure of modern agriculture is built. Genetics, plant physiology, pathology, entomology and other branches of science study nature and emerge with solutions to farmers' problems. Meteorology is yet another field of science with great potential to help farmers. Only a fraction of this potential is realized at present. All efforts to harness research in meteorology to improve the well-being of farmers are therefore most welcome. The present volume is an attempt in this direction.

To say that weather can make or mar a crop is to state the obvious. Total quantity and distribution of rainfall, humidity, temperature, wind and cloudiness are some aspects of weather that have profound impact on yields. Yet, a lot remains to be discovered. Unfortunately, weather study offers limited scope for experimentation in so far as vagaries in weather parameters are beyond our control. Hence, like in geology or astronomy, there is greater

emphasis on observation and recording data than there is on laboratory work.

One positive legacy of the British Raj in India is a hundred year-long database on weather. India Meteorology Department (IMD), New Delhi and Indian Institute of Tropical Meteorology (IITM), Pune constitute the backbone of data gathering and research in weather in India. Principally, this is regarded as the realm of physics. However, complexity of the phenomena is of such high order that it is often expedient to treat them as black boxes and attack them using statistical tools. The purpose of much of the research is twofold. One is to understand the manner in which the weather story unfolds and second is to predict its development. These exercises have to be dovetailed with agriculture to ensure benefits for farmers. State universities of agriculture generally have a separate department of agro-meteorology for such a purpose.

Conventionally meteorologists make a distinction between climate and weather. The former term is used to denote long-term trends, while latter is for short term. Hence climate has to be taken into account for strategic purposes. Coconut trees occur naturally in warm, humid and wet climate. Such aspects are relatively better known, perhaps because these are stable features. The present book aims at adding value, not to climate, but to weather data. I presume this means offering dynamic/tactical advice in response to latest weather reports. A book is therefore expected to provide rules used in such work and any experience in application of such rules.

Some uses of weather prediction are obvious. If you expect showers in the next couple of days, better not irrigate your potato field. Excess moisture may cause rotting. If there is a frost warning, you should keep your orchard warm by slow burning of farm residues or even spraying water on the apples. If overcast skies are predicted, it is better to quickly harvest your cauliflower. Cloudy weather makes the produce 'loose' and it fetches lower price. Such instantaneous use of weather forecast presumes a real-time interaction between the weatherman and farmers. Even when it exists, translating weather forecast into action requires understanding of crop-weather relationship that is far subtler than what is adequate in the above examples. Hence a major thrust needs to be developed in the crop-weather modelling front. We need to

build decision support systems that will allow the farmer to weigh the pros and cons and hedge the bets. It will be beneficial if we can predict onset/intensity of pest/disease attack. But can we go one step further and recommend optimal actions? For example, is it best to spray pesticide right away or should one wait for a shower that will wash away the pest? This is the challenge of adding value to weather data.

Another major potential use of a good crop-weather model is for crop insurance. All our efforts to protect the farmer against the risk of crop failure have been non-starters. It is simply too difficult to estimate 'losses' through traditional crop-cutting experiments. A new and pragmatic idea is weather insurance. Weather is monitored easily and accurately. One measurement applies to all farms in one locality. If actual yield can be estimated using these data, compensation, if any, can be paid promptly. This approach is being put into practice by the Agricultural Insurance Company of India and its website gives a good idea of the so-named Varsha Bima. This opens up a vast field in which crop yield forecast models based on weather data will have to be developed for every locality and every crop variety. My off-the-cuff estimate is that we need about 100,000 different crop-weather relationship models.

A lot of benefit can be derived at the strategic level even without elaborate models. I am reminded of an incident I heard from Sulochana Gadgil. It concerns a groundnut variety developed at Coimbatore and used by farmers in dry areas of eastern Karnataka. Many farmers complained about rains at the time of harvest. This can be a major difficulty in case of groundnut. It turned out that the time to maturity of the chosen variety was such that a chance of showers in this area at harvest was quite high. So, the variety was less suited to the area considering the rainfall pattern there. How often do we check this aspect?

All in all, a major breakthrough is possible if we put together farming expertise and weather research.

How well does the present book fulfil this promise? It offers advisory service to producers of coconut, arecanut and cocoa. It is an edited book. Fifteen authors, all scientists at the Central Plantation Crops Research Institute, Kerala have written ten chapters. There are laudatory messages by the Director General and Deputy Directory General of ICAR. The

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book is printed on excellent glossy paper and included are 150 colour photographs. The price of Rs 230 is modest for any library, though I wonder if an individual farmer can be persuaded to buy it. Let us focus on the advice offered. Some of it is regarding general agronomic practices ('avoid shallow planting', p.15 or 'Place only dried leaves in the basin', p. 30). Some are so widely known as to be superfluous ('Plant casuarinas to serve as wind shield', p. 10 or 'Cut heavily infested leaves and burn', p. 51). Some are precise ('place pheromone traps @ 1 per hectare', p. 53). But only a few are explicitly about weather (During cloudy weather...adopt...drying methods for getting good quality copra', p. 79). Some encouraging news is found (p. 89) that demonstrates the ability to forecast incidence of bud rot in coconut. Very high humidity and cool temperature seem to promote it. The advice to farmers is 'Upon forecast of occurrence, take prophylactic measures'.

So, there are some redeeming features, but in general, I am hard-pressed to locate gems of insights that can justify the ambitious title.

Sometimes I wonder about a tendency in some institutions to put out fancy, glossy documents titled reports/manual, etc. These are not journal publications. Many would not stand peer scrutiny. The present document purports to be more than that, a priced publication, a book. But it seems to have been put together with inadequate effort. Editing is not sharp. Some pictures are repeated (copra dryer on p. 78 and 93, water harvesting pond on p. 24 and 92). Some pictures have obscure justification. Why would anyone want to see a picture titled 'heap of coconut leaves' (p. 45)? The same comment applies to 'coconut palm' (p. 4) and 'cocoa tree' (p. 7). On the other hand, some crucial data such as number of farmers taking advantage of extension services related to weather or estimate of savings from forewarning, etc. are hard to find.

One can only hope that the institution will iron out such deficiencies when it brings out a second edition.

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A Textbook of Medical Instruments. S. Ananthi. New Age Intl (P) Ltd., 4835/24 Ansari Road, New Delhi 110 002. 569 pp. Price: Rs 275.

It is difficult to write a textbook. It is daunting to write a textbook on biomedical instrumentation. Biomedical technology is an area that resulted from an unlikely fusion of a heuristic, largely intuitive practice of medicine and the precise processes of engineering. Ananthi must be commended on the work (wo)man-like job done on this book.

The book covers in detail various small and large diagnostic instruments. All relevant branches of medical practice are covered. Anesthesiology, radiology, various branches of medicine, and some of the instruments involved in surgery are presented, though the choice of instrumentation seems to be based on what was accessible. As the preface and the blurb indicate, a lot of information given is derived from commercial products. Adequate acknowledgements do not seem to be made. The publishers may have to verify on whether any copyright issues are involved. The quality of many of the illustrations is poor, probably due to the process used to scan these from commercial literature.

The chapter on surgical instruments is cursory. This may have to do with limiting the size of the book that is already nearly 600 pages long. Minimally invasive surgery is now becoming a rule rather than an exception to minimize hospital stay. Lasers are used for many more applications than ophthalmology alone. May be these areas will get more attention in a subsequent edition.

It is not clear why a heart-lung machine is included in this book. This leaves the door open for a whole gamut of other devices like plasma pheresis equipment, dialysers, artificial kidneys, and left ventricular assist devices to claim inclusion. A disproportionate amount of space has been given to describing an antiquated disc blood oxygenator, which is virtually a museum piece now. Even small surgical centres now use capillary membrane oxygenators.

If pacemakers and defibrillators can find a place, why are devices like hearing aids, cochlear implants, and deep brain stimulators excluded? Currently used pacemakers have batteries lasting more than seven years and have smart circuits that give warning prior to loss of power.

The book describes units with antiquated mercury batteries having one-year life.

A lot of materials science is involved in biomedical instrumentation. A pacemaker lead just delivers tiny current pulses to the heart, but it has to have a fatigue life in the region of 300 million cycles in a seven-year period. Tissue compatibility of materials is another major constraint. Many of these have a bearing on compromises to be struck in designing actual systems. Even when biocompatibility is not a primary concern, other pitfalls lurk. Initially, stainless steel was used as an ECG electrode material. There is a recorded case of a patient being given five defibrillation jolts because of a flat ECG trace, though in fact the heart started working with the first shot. The culprit was the stainless steel electrode that got passivated and blocked the signal! A chapter on related materials science aspects would have been useful.

Between the engineer and the doctor it is easy to forget the *raison d'être* for biomedical instrumentation. The patient. Quite often, many different instruments are connected to a patient. Some of them may have leads connecting directly to vital internal tissues like the brain or the heart. It is of vital importance to design all instruments to be safe even under abnormal conditions. The concept of patient as the centre of electrical ground is at the core of all instrumentation. Considerable care is required to avoid circulating currents, occasionally through unlikely paths of a surgeon's hand touching the patient. The book rightly addresses this problem and emphasizes the importance of patient safety.

There is the occasional typo, which seems inevitable in the modern publishing context.

Merits are many, faults are few. As a whole, this is a useful book for students taking a course in biomedical technology. It will serve as a basic reference for research workers and medical professionals. It will have but limited use in the actual design of biomedical instruments. The book is worth library shelf space.

The publishers should be complimented on bringing out a good book at a reasonable price on a difficult field of study.

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