

it is not rational that the hitherto higher insecticide use against bollworms can be substituted by a fewer sprays against sucking pests, a trend that is seemingly capturing the fancy of researchers and farmers alike, currently. Like the use of insecticides requiring strategies for insecticide resistance management (IRM), *Bt* cotton cultivation has already elicited demand for *Bt* resistance management (BRM) for the target insect pests. IRM or BRM on any crop for polyphagous pest(s) although essential, is a limited and unidirectional approach with the strategies positioning the artificial interventions spatially and horizontally (refugia) or temporally (insecticide against late season bollworm) and vertically (stacking of genes).

The efforts and infrastructure to monitor the phenomena and in turn develop strategies would outweigh the designing of cropping systems to promote natural and renewable forces that keep the pests within acceptable bounds. Under Indian conditions, natural enemy-based pest management is still to become a reality due to the lack of systems perspective in crop management and mismatch between the needs and mandate towards addressing pest management issues on a fast track. In the context of changing pest problems due to changing cultivation pattern of cotton, protection practices and changing climate, prospects are high to exploit the simultaneously emerging natural regulators. This requires quick attention into determining the effects and efficacy, and mechanism of association besides formulation of conservation and enhancement methods for harnessing benefits in a cheaper and organic way. Inter-

plant system using an alternative crop and spray of supplementary food for attraction and detainment of predators as potential components of IPM recommended in Australian cotton provide clues of possible success<sup>5,6</sup>. Under Indian conditions, the significantly increased activity of coccinellids, *C. sexmaculatus* and *Coccinella* sp. on cotton with cowpea as an intercrop in the irrigated south zone<sup>7</sup>, and random planting of maize at a rate of 10% of cotton encouraging the predators of sucking pests<sup>8</sup>, reported on conventional cotton, can form a recommendation along with transgenic cotton sucking-pest management. Meanwhile, immediate transitions and openings that permit strategic change towards conservation require the documentation of taxonomic diversity, abundance and their importance, strengthening of the information base through collation of historical records cum traditional knowledge, preparation of crop/production system/regional summaries and building of natural enemy-based IPM advisory system using conservation biological control. In addition, identification, characterization and economic evaluation of conservation practices in a cropping system mode, and addressing the critical areas such as formulation of specific policies for promotion of conservation bio-control, coordination of government policy on pesticides and other agricultural matters affecting biological control, developing strong leadership for conservation programmes with adequate resources and quality control, and effective execution, monitoring and evaluation are the need of the hour. The realm of conservation biological control

needs immediate attention in *Bt* cotton pest management. An active approach to acknowledge the role of native natural enemies and promotion of their effectiveness through landscape ecology is the need of the hour, before embarking on recommending curative measures for sucking-pest management in the rapidly expanding area of *Bt* cotton.

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## Himalayan seismic disaster management

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India is known for its high level of seismicity. A number of large-magnitude earthquakes (magnitude more than 8.0) have occurred in the country during the last few years<sup>1–3</sup>.

The Geological Survey of India (GSI), after three years of field work, has reported that the probability of occurrence of a destructive earthquake of magnitude more than 7.5 in various districts of Uttarakhand is in the range 0.83–0.98. These

probabilistic values, for a geological event such as an earthquake, could be taken as almost a certainty. Bapat<sup>4</sup> has discussed this observation. In addition, a number of researchers<sup>5–7</sup> have observed the possibility of occurrence of a strong earthquake in NW Himalayas. Most of these predictive observations, inferences and conclusions are based on seismic, tectonic and statistical analysis. All these efforts make it clear that a big jolt is imminent. Some

efforts are being made to refine the observations. However, according to Freund<sup>8</sup> it should be realized that earthquake prediction is possible with the help of the non-seismic, non-geologic and non-geodetic approach. He has discussed electrical, magnetic, electromagnetic and atmospheric measurements for finding a reliable earthquake precursor or precursory situation. At present, the overall situation is that the NW part of the Himalayas in

Uttarakhand and Himachal Pradesh is going to be hit by a big earthquake in the near future.

Once it has been scientifically accepted that a big seismic jolt is imminent, it is necessary that suitable mitigation measures be undertaken on war footing so that the loss of lives and property is minimized. After the Bhuj earthquake, the Government of India and several State Governments have established a number of disaster management institutes. These institutes have been assigned the work of disaster management and mitigation. As is well known, an earthquake does not kill anybody, but it is the collapse of man-made structures which kill. This sentence has been heralding the new era of disaster management in India and remains the guiding message for all disaster institutes. As such, the earthquake mitigation efforts are mostly and correctly confined to the promotion and propagation of the philosophy of building earthquake-resistant houses and strengthening of existing houses. The Bureau of Indian Standards (BIS) has come up with a number of codes for different types of constructions<sup>9,10</sup>. These efforts are definitely encouraging.

The structural engineering-oriented efforts for earthquake disaster mitigation have certain limitations. These have to be formulated during the design stage and implemented during the construction stage. People are somewhat reluctant to incorporate these measures during construction and for strengthening, mostly because of additional cost. The present municipal rules and regulations do not make it mandatory that the design, construction and building should be according to relevant seismic codes. As such, the number of seismically vulnerable buildings in India is more than 98%.

The disaster management agencies have also been active in teaching people what to do during a co-seismic period such as running immediately to open ground or taking shelter under a bench, table or door frame, etc. Instructions for actions during the post-seismic period for rescue, evacuation, emergency, help, etc. have also been effectively undertaken through demonstrations, lectures, pamphlets and the media. This is a sign of good efforts.

At present, instructions to people about earthquake disaster management are for the co-seismic and post-seismic periods only. There is no instruction for the pre-seismic period. Unfortunately in the present administrative set-up, no official will visit people during the pre-seismic period to tell them about an imminent earthquake. But during the post-seismic period, a large number of officials will visit the affected people with food, tents, medicine, clothes, etc. and with compensation funding to relatives of the dead. This scenario has been repeated after the Latur (1993), Jabalpur (1997), Bhuj (2001), Andaman (2004) and Kashmir (2005) earthquakes. This pathetic situation has to be changed at the earliest. Are we ready to face a similar situation again in Uttarakhand in the near future? The issue needs to be seriously pondered at the national level. The sole reason for this is lack of knowledge about earthquake precursors and earthquake prediction. Most of the earthquake disaster management experts, agencies and offices have a strong 'conviction' that an earthquake cannot be predicted. They are correct to some extent. Till now, there was only one case of successful earthquake prediction in China. Earthquake prediction has almost become a taboo in most of the disaster management offices. The relevant rules also are empowered to take penal action against anyone who talks about earthquake prediction. As a result, an impression is inadvertently created in the society that most of the disaster management agencies come in the picture during the post-seismic period to clear the debris and the corpses.

The present seismic situation is skewed. On the one hand, it is accepted that a large-magnitude earthquake is due and it may occur anytime. On the other hand, most of the disaster management agencies feel that an earthquake cannot be predicted. If we want to protect people from an earthquake, it is essential that a suitable precursory warning be issued. This is a peculiar and complex socio-scientific enigma. It is necessary that all concerned experts discuss this problem and come out with a suitable viable solution. The main aim should be saving the lives of people. If the assumption that 'earthquake

cannot be predicted' is allowed to rule and guide the entire disaster management procedure and scenario, then the country may witness a large number of deaths. The last earthquake of magnitude 8.25 in this region occurred on 4 April 1905 in Kangra (Himachal Pradesh). At that time the death toll was 20,000. If an event of similar magnitude occurs in the near future, the losses could be two (or more) orders larger than the previous death toll. This observation is estimated on the past (1905) and present populations of the region.

At present the subject of earthquake prediction has not reached a stage of perfection, and till now there has been only one successful case. Non-maturity of the subject and the observation that some of the precursory indicators (such as abnormal animal behaviour, etc.) are not acceptable and are not fitting in the presently accepted scientific framework, should not be a sufficient reason to throw away other precursors. One should accept them with open mind till they are found reliable. This will ensure that our disaster management offices help in saving lives and are not meant only to clear the debris and corpses.

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