

Rats are also controlled by employing the same principle. Branches, preferably of bamboo, are put in terraces. They act as a resting place for owls at night, which will keep the rat population in check.

The Khasis of West Khasi Hills practice another interesting method, and use cow's blood to repel birds from paddy fields. A small bird species, locally known as *phreit*, comes in flocks and damages the paddy, breaking the tillers. Usually it destroys the crop during the maturation period. To stop this, farmers put fresh cow's blood in a bamboo pipe. The pipe is tied with a stick and is placed in the paddy fields. According to the farmers, after 2 or 3 days the blood starts to emit a smelly gaseous substance, which acts as repellent to the birds. This practice also suggests an understanding and exploitation of the principle of animal behaviour, as it seems to mimic situations where alarm behaviour of the birds is used to prevent crop damage.

Perhaps the most widely-used of all the traditional pest management practices is the use of decomposing crabs to control rice bugs (as the filling of paddy grain starts, locally available crabs are smashed and put on pointed bamboo sticks in terraced paddy fields). This is practised throughout the entire state by all communities. An in-depth study of the practice suggests that it is an exploitation of the principle of food preference. This practice is environmentally friendly, as some farmers replace the crab baits as soon as they dry up, which otherwise may lead to elimination of the bug species from the natural ecosystem – not desirable from a conservation point of view. It also conserves water, as collecting the crabs lessens the



Photo: Sangita Roy

The crab bait traps can be used in combination with other traditional methods of managing pests.

loss of water through crab holes. Though other small animals like snails or frogs can also be used to attract the bugs, crabs are believed to be more effective. On-farm trials of the method

Traditional ecological management of

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Potato is an important crop in the state of Meghalaya, India, occupying a major place in the agrarian pattern as well as in the dietary habits of the population. However, the average productivity here is only 9.2 t/ha, far below the national average of 18 t/ha. Factors like rainfed conditions, non-availability of quality seed, and high disease incidence, contribute to the present poor yield level. Potato is grown in two consecutive seasons: summer is the main potato-growing season that extends from February to June-July, while autumn extends from July-August to November-December.

Common potato cultivars

Khasi tribal farmers grow improved potato varieties as well as local varieties. They usually grow a mix of these varieties according to their characteristics and suitability. For example, *Kufri Jyoti* is a high yielding potato cultivar which covers over 50 percent of the total potato growing area in the state. Farmers prefer this variety for its taste and better cooking and keeping qualities. Initially it was highly resistant against late blight, however it has recently become very susceptible, causing low yields. *Kufri Megha* is another popular variety, liked for its taste and cooking quality. However, it is slow bulking and long duration, so it cannot be included in all the crop rotations farmers use. Farmers realise that its high resistance against late blight helps assure production, and therefore income.

Hence, even if this variety is out of the breeder's seed production chain, farmers maintain its seed independently. *Kufri Giriraj* is a recently introduced variety. It is high yielding as well as resistant to late blight, and is gaining popularity. However, farmers are still doubtful about it, owing to its poor keeping quality and short dormancy.

Late blight is the major potato disease in Meghalaya. It appears in epidemic form every year around the second week of May, and causes total crop damage within 15 - 20 days of appearance. In cases of severe incidence, even the stem and tuber are affected. The affected leaves turn from green to brown or black, get dry and develop white cottony growth on the underside. The disease continues till October, affecting the summer as well as the autumn potato crop. However, the damage is higher in the autumn crop as it affects the crop in the initial growth stage.

Farmers' wisdom of traditional late blight management

Through experimentation, farmers have evolved a unique way to cope with the late blight menace. They have utilised the limitations in potato cultivation to their benefit, by adopting different crop rotations in low-lying areas and on hill slopes. In low-lying areas, farmers practise a potato-paddy rotation, whereas on hill slopes a potato-potato/vegetable rotation is followed.

For the management of the potato-paddy rotation in low-lying areas, farmers follow two practices. Firstly, they plant potatoes

revealed that by using a crab of 2.5 x 3 cm size as bait, 80 - 85 bugs can be trapped per 5 m² in five days. Impressed by the effectiveness of the method, the state government has recommended its inclusion in the formal plant protection package. They are promoting a modified trap through agricultural bulletins, and at farmer trainings. The modified technique has been incorporated in the IPM recommendations for rice bugs, and is being successfully implemented in the entire state. Though there are no figures about how many farmers have adopted the customised trap, many farmers simply use the crabs in the traditional way. In all, the whole farming community can benefit from the renewed interest in age-old traditional methods.

The way ahead

The above descriptions are just a few of the hundreds of traditional ecofriendly pest management practices developed by the traditional farmers of Meghalaya in response to the pest problems emerging from the newly introduced wet terrace cultivations. The uniqueness of these practices is their suitability to the local conditions; they are inexpensive and easy to implement. The farmers state that when they use these methods in combination, they can be very effective. As different practices are used for the same purpose (pest) at the same time, one practice complements another, resulting in less pest damage to the crops. To be recommended for wide-scale use, however, these traditional practices need further evidence and modification. Nevertheless, integration of the authenticated traditional methods and their wider applicability may ensure

a more sustainable and higher return from the fields – a step towards the reduction of rural poverty and hunger. Lastly, if the pest problems are taken care of, wet rice cultivation may prove to be a good alternative form of cultivation for the traditional farmers of Meghalaya in particular, and shifting cultivation areas in general.

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late blight in potato

comparatively early (by the first or second week of February), and harvest it in the first fortnight of June. After harvest, farmers prepare land and sow paddy by the end of June. In this way, the potato crop has three months to mature before it dies with late blight incidence. Secondly, in these low lying areas, the *Kufri Jyoti* variety is used. Although it dies before full maturity, *Kufri Jyoti* yields well, and damage to the crop is minimised by early planting and harvesting. This also allows for timely planting of paddy. After harvest, farmers sell the potato crop immediately, and fetch a premium price for the early harvest. This compensates for the yield loss due to early harvesting and late blight damage. Supplementing the practice of early planting of potato, farmers do not spray any fungicide for late blight management. Thus, potato is harvested in the first week of June and ecological sustainability is ensured.

Khasi tribal farmers select seed potato from the crop grown on the hill slopes, saying that disease incidence is lower there. These potato varieties also suit the crop rotations used on the slopes, and meet the requirements for seed potato. The majority of the farmers do not spray fungicide on hill slopes as they prefer to harvest early so as to prepare land for the second crop, such as cabbage or cauliflower. Farmers perceived that spraying fungicides on the crop could lead to increased duration of the crop, which is unfavourable for this cropping sequence. In addition, spraying the crop with fungicides may not greatly increase its yield, as late blight appears in a

devastating form by the second fortnight of May and the entire foliage of the crop is destroyed by the first week of June. By this time sufficient tuberisation has already occurred in the crop. Thus, spraying summer crops with fungicide is felt not to be cost effective.

Implications

Farmers' traditional methods for managing the potato late blight in the Meghalaya hills are successful examples of ecological disease management and an established outcome of traditional experimentations. Such farmers' wisdom ought to be given attention in formal research systems. Moreover, by avoiding chemical fungicides, but rather working with the conditions they face, they are encouraging local ecological sustainability, which is important in such rainfed and hilly areas. This provides an opportunity for late blight management scientists to examine and validate such practices.

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