Managing Pests without Pesticides

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Abstract

In 2003, a small village in the Indian state of Andhra Pradesh, declared itself pesticide-free. Since then, its farmers have stopped using pesticides for crops like cotton, Bengal gram (chick pea), chilli and paddy — all known to use notoriously high quantities of pesticides.

The pesticide-free status of Punukula, Khammam district, a predominantly tribal village, is creating ripples in the state of Andhra Pradesh (AP) India. Andhra Pradesh has been reeling under frequent spells of drought over the past five years, and has reported thousands of farmer suicides. An estimated 1200 suicides were reported in the period June-August 2004 alone. One of the reasons for the rise in suicides has been the crushing burden of debt: many farmers buy expensive seeds and pesticides and when the crops fail, their own survival becomes difficult. In addition to supplying seeds, fertilisers and pesticides, input dealers started extending loans at high interest rates to the hapless farmers. The debt trap was fast closing in on the farmers whose yields were greatly affected by pests. Farmers in Punukula, like elsewhere, started committing suicide.

In 1999, the Socio-Economic and Cultural Upliftment in Rural Environment (SECURE), a local NGO, stepped in and suggested that the farmers try out ecological methods to control pests. The determination and support of the five self-help groups (SHGs) run by the village women helped to make this ecological shift in pest management possible.

Punukula farmers now claim that they are able to save up to Rs 3 million (US$1 = Rs 46) every year on agricultural inputs in the 600 acres of Punukula farmlands by adopting eco-friendly methods towards pest management. They have saved at least Rs 5000 per acre since reducing their dependence on expensive pesticides. Their success in eliminating the use of artificial pesticides from cotton fields has been the most remarkable when the pests became resistant to the pesticides being used.

SECURE initially began work with 20 farmers, including a few women. In the beginning, when the farmers were beginning to be skeptical of the interventions, members of the women SHGs

stepped in. Realising that the savings with the new methods were enormous, up to Rs 10,000 per acre at times, they firmly and successfully persuaded their men to stop buying pesticides. The women were so determined that they even took on the additional work of preparing the anti-pest sprays from neem (azadaricta) and chilli-garlic paste. They also ensured that no one brought pesticides into their village.

With initial successes, slowly, others also started realising that pesticides meant higher debts as well as high medical costs. By 2003, most farmers in this 200-household village had stopped using the harmful pesticides. Pesticide dealers stopped coming into the village as sales dropped dramatically. Besides covering 400-odd acres of cotton, the new method was also used in fields growing chilli and paddy. Today, Punukula is a centre of attraction for other villagers who are inspired and impressed by its healthy crops.

Introduction

Today agriculture is passing through a difficult phase. The ever increasing costs of cultivation due to excessive dependency on the external inputs, high fluctuations in market prices due to opening of up of markets, reduced public support after liberalisation and the monsoon vagaries have made agriculture based livelihoods unviable. The spate of farmers' suicides, particularly in Andhra Pradesh and across the country, are only the tip of the iceberg. The crisis needs to be understood and several long-term initiations have to be made to solve it.

Agricultural chemicals, especially pesticides, occupy major costs in crops like cotton, chillies, etc. The inevitability of pesticides in agriculture is promoted by the industry as well as the public research and extension bodies.

The dominant paradigm of pest management largely depends on chemical pesticides. Pesticide sprays are resorted to when the pest is in a damaging stage (in terms of the pest life cycle) and state (in terms of intensity of incidence). However, pesticides being used become ineffective in no time since such a use allows for insects to be selected for genetic resistance rather than controlling them. On the other hand, replacing chemical products with biological products may not solve the problem without a fundamental change in the perspective or thinking towards pest management. The Integrated Pest Management initiatives have come up as an alternative, although they largely centre around debates about pesticide effects on human health and on the environment. People still believe that pesticides are inevitable, at least as a last resort. The 'alternatives' are now commercialised by the market. One such alternative, which has much serious consequence, are the genetically engineered crops that are released as well as lined up

for release. The new markets not only sell the alternate products, but also dictate the methods to be adopted (organic farming certification standards, for example).

Under Non-Pesticidal Management, the primary focus is on replacing the external inputs with the local knowledge, management skills, labour and effective utilisation of natural products and processes that are locally available. The farmers understand the pest biology and life cycle and modify crop management practices to keep the insect population under check, and stop insects from reaching a pest status.

In the four stages of the life cycle, insects damage the crop only in one stage (larval stage in most of the cases) — at least two of the stages are immobile (egg and pupa). The adult stage will not be on the crop. There are several options available to control them at each of the stages, mostly using local resources.

All these doesn't require the so-called 'expertise' but only accepting and respecting the knowledge and skills of the farmers, supporting them to enhance their knowledge base with the demystified modern science.

The dominant paradigm that still, by and large, tries to find solutions in marketable technologies and commodities have to change. The public policy support, which encourages such commodities, has to change. The research system, which has already set its agenda to work and promote such technologies, should reorient its priorities and work towards more farmer-friendly methods and technologies. A shift in the mindset and in the perspectives of thinking is needed.

What this calls for is a shift in the pest management paradigm currently being adopted.

Shifting paradigms

Myths	**Realities**
Pests can be controlled only by killing them	This is the gravest mistake that the current pest management paradigm makes — it believes that pests can be controlled only by killing them. The pesticides and pesticide incorporated plants (e.g. Bt cotton) are based on this wrong premise. They all act only on larval stage when the damage already starts happening. A pest outbreak is waited for, after which powerful pesticides are brought in. This is only a 'curative' attempt rather than a 'preventive success'.
All insects in the field are pests	There is an indiscriminate outlook towards the various insects that are present in an agricultural field and around it. Even though modern

	science is talking about the natural enemies, the pesticides they produce and promote kill all the insects indiscriminately. This obviously also destroys the natural predators of the pests. When the ecological balance is thus destroyed, the pesticide-resistant pests take over.
No relationship exists between monoculture and pest incidence	The current pest management paradigm either does not appreciate or chooses to ignore the relationship between monocultures and pest incidence. It is well established that such mono-cropping over large contiguous areas and a reduced genetic base with mono-culturing germplasm results in an unobstructed proliferation of the pest. Now with the pesticide incorporated, plants have made these monocultures to gene level, trying to put 'cry genes' against all pests across crops.
Chemical fertilisers and pest incidence are not related	Though it is scientifically known that a plant's vulnerability to pest incidence is higher with the use of chemical fertilisers (due to increased 'succulence' in the plant), the connection is not made in real life. Pests are sought to be dealt with in isolation to the land fertility management issues. This is a classic example of the reductionist views that modern science can take.
Pest resistance is a genotypic issue rather than an environmental one	There is much research going on to develop varieties of plants that are pest-resistant by playing around with the genes. The game plan is obvious here — genes will go hand and in hand with intellectual property rights, which in turn ensure secure markets and profits for the industry. Pest resistance therefore is made a genotypic issue rather than one that involves broad ecological management in the farm. That is where genetic engineering in agriculture also finds its space. In this narrow perspective, what is not understood is that the problem only gets accentuated especially in pest-resistant GE crops when other environmental factors related to the pest's life cycle, etc. are not managed
Resistance management is about using newer and newer generation pesticides (as per the industry), and "about using more	The way to get around the problem of resistance is usually seen in inventing newer and newer molecules by the industry. In a patent regime, such newly developed pesticides mean more profits through secure markets. First came the OCs (organochlorines), followed by the OPs (organophosphates) and carbamates, followed by the much-touted synthetic pyrethroids. Each generation's problems were sought to be solved by the next generation, only to end up by

pesticides, including mixtures of up to five pesticides" (as per the farmers)	creating more problems. The cost went on increasing for the farmers. A 100 ml pesticide of the newest generation can cost up to Rs 1000 per container. The industry continues to grow at 4–5 per cent a year. However, the older molecules, which were found to be problem-causing or ineffective, were not removed from the scene. For some farmers, the way out is to mix four to five different pesticides and spray them together — no one knows the ecological and health disaster that such desperate measures might be causing!
Prevention of pest/disease incidence is about spraying pesticides even when the pest is not present	Farmers in many parts of the country have made pesticide spraying a part of their daily routine — they take a tanker on their back to go and spray pesticides in their fields….'just in case'. Pesticide use is no longer related to a pest and its manifestation in the field. Prevention is understood as spraying regularly, as per a schedule drawn up by the farmer or his industry advisor irrespective of whether such treatment is needed or not.
The benefits from the use of synthetic pesticides outweigh the risks	Finally, it is genuinely believed by many in the scientific establishment and the industry that the benefits from the use of synthetic pesticides outweigh the risks and problems associated with it. However, this is simply not true. It might appear to have an advantageous cost-benefit ratio given their simplistic and reductionistic economic calculations. In fact, the suicides in the cotton belts of the country prove that even the economics has turned adverse with pesticides. However, complete calculations of the entire social, economic and ecological disaster that pesticides have created, especially in the face of safer alternatives, instructs us that the risks and hazards far outweigh any probable benefits.

The message is clear — 'Nature makes insects, men make them pests'.

Non-pesticidal management of insect pests

Understanding the behaviour of the insects and the crop ecology are critical in pest management. Among the four stages (egg, larva, pupa and adult) of the insect pests, normally only one stage is damaging. In most of the cases it is larval stage. In egg and pupal stages the insect is immobile. Learnings from the modern science can supplement the farmers' knowledge to understand the life cycle and ability to identify the insects in different stages.

Again in each stage, insects have various weaknesses and understanding on this helps to take up appropriate measures. For example, some insects like Spodoptera lay eggs in masses under the leaves. Such leaves can be plucked and removed. The pupae of red hairy caterpillars hibernate in the soil during summer. Deep summer ploughings brings out such pupa and exposes them to hot sun, which kills them. The larvae of red hairy caterpillar sare gregarious and move long distances on land. Trenches can prevent these insects from entering the fields. Similarly, these larva are also attracted to *Calotropis* plants. So, placing *Calotropis* twigs all around the field helps to collect the insects. The adults of red hairy caterpillars are attracted to light. Putting bonfires in fields immediately after the first showers attract the adults emerging out of the pupal stages. The adults of whitefly are attracted by yellow colours, so putting yellow-coloured boards with sticky surfaces attracts and traps them. During larval stages, *Helicoverpa* larva can be controlled by shaking the plants in pigeonpea. Spraying neem seed kernel extract and chilli-garlic extract can actually put the larval stages of several insects under control. These are only a few methods that have evolved in using the local resources. All these methods and technologies have evolved from the farmers' knowledge and have been evaluated in the farmers' fields in a participatory technology development process.

While these are all traditional practices, CWS/CSA, along with financial and technical support from Natural Resources Institute and European Union, tried pheromone traps to control the fruit and shoot borers in brinjal (eggplant). The insect is a wide problem in Asiatic countries and cannot be controlled by the regular chemical pesticides. The farmers resort to using 30-40 chemical sprays for this pest. The male adult insects have a behaviour to get attracted to the chemicals (sex pheromones) released by female insects. So scientists were widely using such pheromones to trap the insects. But these were only for monitoring the insect pest incidence. The experiment tried to mass trap the insect in a different model of trap, which is locally made and was found successful. The chemical pesticide usage was drastically reduced.

Several such effective blendings of modern science with the traditional knowledge of the farmers in effectively using the local resources and exploiting the natural processes (ecological balance, natural predators and parasites, etc.), along with the farmers' knowledge, management skills, labour and community action, led to the large-scale successes in non-pesticidal management. These models provide lot of scope to use agriculture labour as an effective input into crop management. The spread of technology is also done through farmers. Their farm groups visit villages and discuss issues with co-farmers to convince them about the new methods and help them to adopt the methods. They are good communicators, as they are practising.

Case study of Punukula

This is the story of how two villages in the Khammam district of Andhra Pradesh put in efforts over a five-year period (1999 to 2003) to rid themselves completely of pesticides. Today, the villagers do not use chemical pesticides at all — they are inspiring other farmers in their district and elsewhere to go the same way and improve their livelihoods. The Panchayat has passed a resolution that they would remain pesticide-free.

The Punukula

Punukula is a small village 12 kilometres from Kothagudem town in the Revenue village of Payakari Yanambailu (consisting of Punukula, Devijatanda, Pullaigudem, Poosaltanda and Kodipunjulavagu) in Palvoncha mandal of Khammam district.

The village consists of 189 households with the population being around 860. There are 128 cultivators and 51 agricultural wage labourer households in the village. Other households are engaged in other occupations. The majority of the families belong to the Yadava community and other BC castes, followed by STs [Lambadas and Koyas]. There are also some SC families in the village. In terms of housing, there are equal numbers of pucca houses and thatched houses in the village, in addition to some tiled houses. As the above data indicates, agriculture is the mainstay of this village, like thousands of villages in India.

Punukula was not a cotton growing village traditionally. About 15 years ago, two or three families of farmers who migrated from Guntur district brought cotton into Punukula. Earlier to that, the villagers grew pigeonpea, jowar, greengram, etc. A few farmers, like Margam Muthaiah, decided to imitate the Guntur farmers and went in for cotton cultivation. “I had not seen or used pesticides before then. When I asked the Guntur farmers what it was that they were spraying on their cotton fields now and then, they would not tell me”. However, realising the market potential, pesticide industry began its marketing efforts here. The farmers, who were mostly illiterate and not supported by the agriculture extension department, would rely on the pesticide dealers to suggest to them which pesticide is to be used, when and in what quantities. Very soon, they were trying several pesticides on their cotton crop. Some of the farmers lost count of the number of times they were spraying, or what they were spraying. However, the pest menace did not decrease.

The villagers of Punukula began using large quantities of pesticides on other crops too by this time. They were spraying deadly chemicals on chillis, pigeonpea and on paddy. Pesticide use on chillis meant discoloration of the produce — this brought down prices by nearly half. However, the farmers did not connect it to pesticides. What should be pointed out here was that their approach

to pest management was to start controlling the pest after it erupts in its larval stage, and not begin earlier.

There were a number of accompanying problems. This included many acute poisoning cases in the village, even of people who died due to pesticide exposure, of suicides of debt-ridden farmers and so on.

Payakari Nageswar Rao committed suicide five years ago in 1999. He used to grow cotton year after year on his land. He could not repay the 70,000 rupees of debt that he had run up with the local 'all-in-one' dealer. When the money lender pestered him for repayment, Nageswar Rao saw no option but to commit suicide. He drank those very pesticides, which accentuated his problems enormously. His wife Veeramma now leases out part of the three-acre land that they own since she cannot manage it on her own. She however continues to grow cotton on the land. To this day, she has not been able to repay her husband's debt fully.

Others, like Korsa Veeramma's husband, Koram Buchaiah of Punukula and Muthaiah of Pullaigudem died because of exposure to pesticides during spraying. There are others who have had to spend a good deal of money for treatment and medical care after acute intoxication from pesticide exposure. For instance, Banoth Mansingh and Maloth Srinu.

Maloth Srinu, son of Hemla Nayak, a young man of 21 years was severely poisoned four years ago when he mixed phorate granules and sprayed it the whole day. He fell unconscious at the end of the day and had to be referred to Dr Nagaraju in Kothagudem for treatment. He was in a coma-like state for two full days and everyone expected him to die. After nearly two weeks in the hospital, he was able to recover. His treatment costs amounted to around Rs 18,000. He now vows never to go near a pesticide tank again.

Man Singh, 35, is considered a 'crack' [mentally unstable] by many in the village. He himself can recollect that he had gone unstable due to an acute poisoning instance. He was using a mixture of Quinalphos and Cymbush in the year 2000 when he fell down in the field. He recalls that it took him three months to recover and a good deal of money spent.

The RMP (Registered Medical Practitioner) of Punukula, Mr Madhu, recollects that there used to be at least 50 to 60 poisoning cases a season earlier to 2000. He would treat many cases, and would also have to refer the more serious cases to the town hospital.

The economics of farming went out of control. They seemed to have gone straight into somebody's else's hands, however — the 'single window, all-in-one' dealer. The 'dealer' was indeed dealing a death blow to the farmers' dreams. He would be the one who would sell them seeds, fertilisers and pesticides — he would give these on credit to the farmers and even supply other credit. However, all of this was at high interest rates of three to five per cent a month. Since the farmers were in no position to repay these loans, the agreement would be to sell their produce to this 'all-in-one' dealer. The dealer in turn would inevitably fix the price at rates lower than the market value. The farmers had no choice but to accept the rate, in the hope that next year's investments would once again be supported by the dealer. The cycle became extremely vicious with no way out. The farmers were now truly on the pesticides treadmill.

Most people in the village recall with horror the strong clutches of the all-in-one dealer. The social stigma of indebtedness, especially at those times when the money lender put pressure for repayment, is unbearable for many. Payam Nageswar Rao had to commit suicide as an escape from this trap.

The beginnings of the transformation

In 1999, the local non-government organisation SECURE (Socio-Economic and Cultural Upliftment in Rural Environment), which was implementing a watershed project under DPAP, approached the villagers of Kodipunjulavanipalem, three kilometres from Punukula to go in for integrated pest management in cotton. This was undertaken as part of an ICRISAT project. Some farmers came forward and they were trained in IPM. Given some positive results here, in the next year, the organisation decided to start a non-pesticidal management (NPM) approach in cotton in Punukula village. Earlier analyses with the villagers about their livelihoods revealed several problems related to their agriculture including lack of support for investment, higher investments each year, lack of marketing support, indebtedness, etc. Realising that pesticides in cotton were playing an important role in the crisis, the organisation decided to work on the issue. However, the farmers were not ready to give up cotton cultivation. Even if it meant several problems, the farmers saw the crop as a good source of income generation in years that it yielded. The NGO also saw this as an opportunity. If pesticides can be eliminated in a crop like cotton (with its intensive use of pesticides), then the convinced farmers will automatically give up pesticides in other crops, SECURE felt. For strategic reasons, it also decided to concentrate on one or two villages like Punukula.

The NPM project was with the technical and financial support of the Hyderabad-based Centre for World Solidarity's Sustainable Agriculture wing (now called the Centre for Sustainable

Agriculture). When CWS was scouting around for areas and partners to begin an NPM programme, SECURE offered to initiate the project in their work area.

SECURE was already working in Punukula on a watershed project. There were five strong women's Self Help Groups as well as a strong Watershed Committee under the capable hands of Hemla Nayak. In 2000, with a great deal of persuasion by SECURE, 20 farmers agreed to be part of the program and try out NPM. The farmers participating in the program were very reluctant as well as sceptical about the efficacy of the NPM approach.

About SECURE

The NGO started work in 1991. The vision of the organisation is 'integrated tribal development through participatory natural resource management and women empowerment'. Over the past decade or so, SECURE has been working for sustainable tribal development through interventions focussed on child development, women's empowerment, promotion of alternative income sources, preventive healthcare and collective action through SHGs and NIM. Their project area is located in Palvancha mandal of Khammam district.

The initial hesitancy

When SECURE personnel approached the farmers with their non-pesticidal technology, the farmers used to laugh at them. This they were doing in the face of aggressive marketing including advertising by the pesticide industry, and the difficulty in the challenge is entirely understandable.

CWS and SECURE persisted in their efforts. On the one hand were farmers who refused to believe that anything like neem or chilli-garlic would work when even deadly pesticides were proving ineffective against pests. On the other hand, there were many farmers who were completely fed up with the situation that they were in. They were ready to check out the alternatives. There were trainings organised for such farmers.

In fact, just as the Green Revolution extension personnel are supposed to have done for chemical fertilisers in those initial days, SECURE extension workers (two of them — one man and one woman — placed in Punukula) would themselves go into the fields and show them the use of alternative technologies while the farmers watched. They brought neem seed kernel to the village and made the extracts in front of the farmers and used them. Similarly, they made the chilli-garlic extract and demonstrated how to prepare it, when and how to use it. The farmers, especially the women, appreciated how easy the preparation of the extracts was. The participating farmers used these extracts replacing the pesticides completely, and they found to their delight that even the bollworm could be controlled.

The sweet taste of success

At the end of the first year, the positive results were already apparent with the IPM approach (Table 1).

Table 1. IFAD–ICRISAT project for IPM in pigeonpea and chickpea, 1999–2000, in the SECURE project area including Punukula

Farmers	Area (ha)	Cost of plant protection		Net profit	
		IPM	Non-IPM	IPM	Non-IPM
45 (3 villages)	50	213	1108	5623	2411

In 2001–02, non-pesticidal management work was taken up on 6.4 hectares, with eight farmers in Punukula on cotton, while in the case of pigeonpea, it was done in seven hectares with three farmers. The approach now was to completely eliminate the use of chemical pesticides in the cultivation, one step forward even from IPM.

Once again, in the non-NPM plots, farmers experienced a negative income while the NPM plots had a yield of seed cotton range between 10 quintals/ha to 18.75 quintals/ha. The average plant protection cost incurred by NPM farmers was Rs 4301 per hectare, and the average net income was Rs 3420 per hectare (Table 2).

Table 2. NPM in cotton, 2001–02

Average yield (q/ha)		Cost of plant protection (Rs/ha)		Net income (Rs/ha)	
NPM	Non-NPM	NPM	Non-NPM	NPM	Non-NPM
15.62	14.72	4301	8596	3420	–5201

By the second year, more farmers joined the effort, as they had witnessed the good results firsthand in the fields of the first year's participants. Farmers were also taken on exposure visits to Warangal. There were more training workshops held in the village. Slowly, word spread and along with it, a serious conviction that getting rid of chemical pesticides is the only way out.

By 2002–03, the NPM concept in Punukula was tried out with a much larger number of farmers, in crops like paddy, redgram, cotton and chilli. The number of participating farmers went up to 59, with an area of 58 hectares under NPM approach to crop cultivation. The increased net incomes were to the satisfaction of the farmers.

In 2003–04, the acreage under NPM cotton went up to 1200 acres in Punukula and Pullaigudem villages, covering all the cotton area of Punukula. The average yield per acre was 12 quintals, with the cost of cultivation hovering around Rs 8563/acre. The net income per acre touched Rs 16637 per acre. In the ten acres of NPM tried out with chilli that year, the average net income was Rs 23,410 per acre. This was unheard of by the villagers in recent times. With chilli, the discontinuation of pesticides also meant a great improvement in the quality of chilli and therefore the produce fetched higher prices in the market.

Table 3. NPM in cotton, 2003–04

Village	**Acreage**	**Average yield per acre**	**Average cost of cultivation per acre**	**Average net income per acre**
Punukula and Pullaigudem	1200 acres	12 quintals	Rs 8563/acre	Rs 16637/acre

In 2004–05, for a second year in a row, nobody in the village has gone anywhere near a pesticide dealer or dabba. The Panchayat is ready to pass a resolution to announce that it is pesticide-free and would continue to be so. From the Panchayat's side, they requested pesticides dealers not to come into their village and market their products.

Farmers of the village were able to get rid of past debts in a couple of years' time. With the debt burden off, the farmers are willing to try out more and more ecological approaches, as well as try it on more crops. For example, Eerla Dhanamma now bought two more acres of land after switching over to NPM. Hemla Nayak says that his debts have been repaid. Man Singh has been able to lease in two acres of land on which he is cultivating cotton without pesticides. Field staff of SECURE point out the various changes — including housing — in the village after pesticides have been removed from their agriculture.

The ecological balance in the fields was restored. There are many more insects present in the fields, without any of them reaching a 'pest' stage of threat. Dhanamma talks about spiders, wasps and beetles returning to their fields. Birds are returning to the village, the villagers report.

The health of the farmers improved — there are no more any cases of acute intoxication from the village. Earlier, each such case would cost anywhere between one and two thousand rupees for the local RMP, Mr Madhu, to treat them. More serious cases would be referred to Dr Nagaraju in Kothagudem town. Such cases would easily cost at least four to five thousand rupees. Now, the

farmers have been spared this unneeded cost. Dr Nagaraju of Kothagudem also observes that acute intoxication cases from these villages have come down.

For the agricultural labourers also, things have improved on many fronts. There was a wage increase from 25 rupees to 30 rupees during the corresponding period (when NPM was practised). They do not have to be exposed to deadly pesticides now, nor incur medical care expenses for treatment of pesticide-related illnesses. Some point out that there is even more work for the labourers — in the collection of neem seed, in making powders and pastes of various materials and so on. Farmers are even leasing in land and putting all lands under crop cultivation these days — this implies greater employment potential for the agricultural workers in the village.

The role of social processes

It is very important to note here that the transformation did not come about easily. It required intense, daily efforts by the NGO initially. Important also were the inputs provided by the Watershed Association and the women's Self Help Groups. The women in the SHGs, for instance, warned their men against going to the market to procure pesticides. They put pressure on the farmers. They took active part in the trainings being organised by the NGO. They started experiencing and observing the difference between using chemical pesticides and the ecological technologies for pest management.

After they got convinced about the efficacy of the NPM technology, the women were willing to put in some extra work in procuring material, creating various 'extracts' for spraying and so on. They would discuss the state of their crops in the meetings and get extension advice about what needs to be done. Today, the women proudly say that they "feel much more confident now. The men listen to us. We are able to save money and improve our living".

Similarly, the farmers' sanghas organised by SECURE were used actively for constant extension, surveillance of crops and active dissemination of solutions.

The women's groups bought a neem seed crushing unit in Punukula in 2004. This was done through the Panchayat with the help of Centre for World Solidarity. Two women find full-time employment running this machine.

The rapid spread of the approach

By 2003, all the farmers in Punukula and Pullaigudem had given up pesticides in their farming. They found that this made a massive difference to their farm ecologies. In Punukula, 174 farmers along with 120 farmers from Pullaigudem soon became capable of explaining to others the

principles behind the new pest management approach and about how they were benefiting. Word spread both in sporadic ways and in a structured manner. Punukula farmers themselves decided to proactively spread the NPM message to nearby villages. Every relative that visits the village gets to hear about the transformation. Similarly, when Punukula farmers go to other places for other social purposes, they make it a point to bring up their story of NPM.

In neighbouring Kodipunjulavagu, farmers have given up pesticide use in cotton crop. Only in paddy do they continue to use pesticides once or twice. This meant a decrease of about 80 per cent in their pesticide consumption, they say. In Prabhatnagar, farmers have slowly begun listening to the words of SECURE. Many farmers are coming forward to try out alternative approaches. Across the stream in Pandurangapuram, farmers have learnt from each other to give up certain kinds of pesticides. The abuse levels have come down drastically. The success of Punukula and Pullaigudem is slowly spreading on its own.

There are hundreds of farmers from other places regularly visiting Punukula in an effort to save themselves from a crisis situation. All of them go back inspired, with a ray of hope born inside them and with an urge to follow a similar path in their own villages.

The technology that was used

The main principles underlying the technology were that:

- there is a natural ecological balance required for control of insect populations before they assume the proportions of being pests — that nature can restore such a balance if it is not meddled with too much
- understanding the life cycle of an insect is important to manage pests — it is not enough if reactive sprays are taken up once there is a pesticide outbreak. The preventive aspect of preventing large-scale egg laying, of larva formation, of luring the pest away from the main crop, etc. are very important
- crop diversity and soil health play an important role in pest management
- pest management is possible with local natural material — the availability of such material or affordability is not under question. This increases self-dependency of farmers and does not put valuable resources of farmers in the hands of outsiders

Based on these principles, the following practices are followed under the NPM method:

- Deep summer ploughing
- Light traps and bonfires to attract moths
- Yellow and white sticky boards in the fields
- Manual removal of the leaf surfaces on which heavy egg-laying took place

- Pheromone traps for pest incidence surveillance
- Neem seed kernel extracts and chilli-garlic extracts to control bollworm and sucking pests
- Cow dung and urine extract for controlling aphids and jassids
- Castor and Marigold as trap crops.

What seems to have contributed to this change

- The readily organised groups in the village
- The efficacy of the method — the establishment of the technology — it gave the farmers not just savings on the cost of cultivation but kept their yields in tact, if not increased the yields. Net incomes of the farmers increased. The farmers were able to get rid of their earlier debts. The relief this brought allowed them to spread the technology to other crops
- Women being included into trainings and being treated as farmers — they were involved in perspective building and they showed their mettle when it came to firmly using their newfound knowledge
- The intensive extension support provided by the NGO by stationing two personnel in the village
- Farmers' own experiential learning, rather than bookish-knowledge-dissemination by outsiders
- Farmer-to-farmer extension work
- Right timing for interventions — the frustration levels with pesticides and various agricultural problems were so high that the organisation stepped in with alternatives at the right moment
- Participatory problem analysis — constant dialogues with farmers about the progress that they were making
- An intensive anti-pesticide campaign in the village — leaflets on the subject, an audio cassette on the subject played in meetings, etc.
- Alternatives and their preparation put up as wall writings in a prominent place
- More and more visitors coming into the village and sharing their own problems convinced Punukula visitors that they were on the right track.

The spread

Today, the lateral spread of the Sustainable Agriculture Programme (by 2003–04) by sustained intervention from various organisations supported by the Centre for Sustainable Agriculture/Centre for World Solidarity covers 92 villages across six districts where over 5000 farmers participate. Farmers across an estimated area of 6000 acres are already adopting the methods. The farmers from these villages are acting as resource persons in several of the training programs organised by NGOs and government organisations.

State government initiatives

The state Minister for Agriculture, Mr Raghuveera Reddy, visited the village,Punukula and discussed the success. He promised to take up the experience further into larger areas in more than 200 villages. Several other NGOs and the Department of Rural Development, etc. are also keen on adopting the methods.

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