

REDUCING PESTICIDE USE IN PADDY AND GROUNDNUT THROUGH INTEGRATED EXTENSION APPROACH IN PONDICHERRY

In Pondicherry region is blessed with natural resources for cultivation varied crops. The cropping pattern indicates that paddy is grown in about 26000 ha, pulses in 6000 ha, sugarcane in 2500, groundnut in 1200 ha and vegetables in 750 ha. During the early nineties the problem of insect pests and diseases in various crops is rampant and raising. The problem attained more prominence with the introduction of high yielding crop varieties and the associated increase in consumption of pesticides and fertilizers.

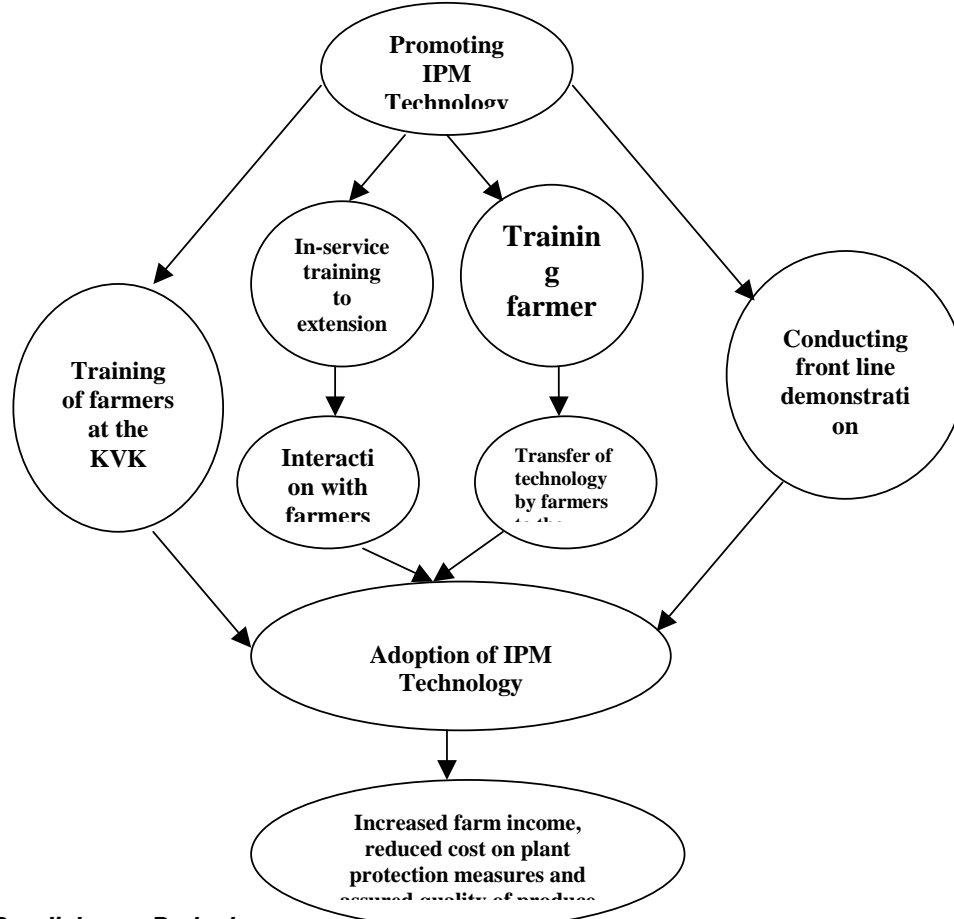
In Pondicherry, attempts to develop and use IPM modules against crop pests were being carried out since 1994 aiming at suppressing the crop pests; reducing the cost of production to farmers and ensuring quality produce to the consumers. The strategy includes integration of cultural, mechanical, biological and traditional practices with chemical control being advocated as a last resort.

Keeping this in mind, the State Biocontrol Laboratory was established in the KVK in the year 1997 at an outlay of Rs.50 lakhs under the aegis of Government of India to mass produce Bio agents against a number of pests and diseases of major crops.

As such, awareness on the use of various pest management measures including bio suppressers for different crop ecosystems had been created by high-profile campaigns and field visits. This had evoked interest among the farmers in adopting the IPM practices. As of now, more than 60 per cent of the farmers adopt the IPM measures to contain the pest menace. Trainings, Front Line Demonstrations, On Farm Testing and Method Demonstrations have been used systematically to convince and disseminate the IPM practices to the farming community (Fig.1).

The success achieved in promoting Integrated Pest Management in Pondicherry is mainly due to the awareness created and IPM skills transferred to the farmers. The KVK could successfully change the attitude of the farmers towards IPM methods of crop protection. The KVK not only trained the farmers but also the extension functionaries of the Department of Agriculture who in turn trained farmers in their respective jurisdictions through Farmers' Field Schools.

Fig. 1. Modus operandi of promoting IPM in Pondicherry by the KVK



Training

The training programmes on IPM were conducted for crops like paddy, groundnut, sugarcane, coconut, banana, vegetables and flowers. During the seven years period, 1997-98 to 2006-07, a total of 37 training programmes were conducted with 923 participants (Table 1). Over the years, the duration of the training ranged from one to five days and more number of trainings were conducted in paddy followed by groundnut and sugarcane.

The following were the IPM technologies advocated to the farmers by the KVK based on the occurrence of various pests and diseases:

- Keeping light traps to monitor the pests.
- Installation of pheromone traps.
- Use of “T” shaped bird perches.
- Use of Trichogramma egg and larval parasitoids.
- Application of neem oil.
- Application of bacterial bio-pesticides like *B.thuringiensis* and *Pseudomonas fluorescens*.
- Use of viral bio-pesticide Nuclear Polyhedrosis Virus (NPV).
- Application of fungal bio-pesticides like *Trichoderma viridi* and *T. harzianum*.

Table 1. Details of training on integrated pest management imparted by the KVK

Year	No. of trainings	No. of Participants	Duration (day)	Crop
1997-98	1	18	2	Paddy
1998-99	4	79	2-5	Paddy, groundnut, and sugarcane
1999-00	3	70	1-5	Paddy, groundnut, and sugarcane
2000-01	4	90	2-3	Paddy, coconut, groundnut and sugarcane
2001-02	4	89	2-3	Paddy, banana, and groundnut
2002-03	2	30	2	Paddy and groundnut
2003-04	5	104	2-3	Paddy, groundnut, vegetable and floriculture crops
2004-05	4	114	2-3	Coconut, groundnut and vegetables
2005-06	7	266	2-3	Paddy, coconut, groundnut and vegetables
2006-07	3	63	3-4	Paddy and vegetables
Total	37	923		

Advisory Service

To bridge the gap between the researchers and the farmers’ field visits and farm advisory services were conducted. The data presented in Table 2 indicate the number of farm advisory services, guest lectures, method demonstrations and number of farmers visited KVK to seek solutions against the infestations due to pests and diseases during the period 1997-98 to 2006-07.



KVK scientists visiting a farmer’s field

- Four hundred and seventy field visits were made by the team of Entomologist and Pathologist to various villages located in Pondicherry region to suggest suitable remedial measures to contain *in vivo* problems effectively.
- One thousand and seventy one guest lectures on biological control of crop pests and IPM for various crops were delivered to the farmers and farm women.

- Over the years, 31 method demonstrations were conducted on innovative and useful IPM technologies for crop pests in various villages of this region.
- About 2276 farmers visited this Kendra during the said seven years period to seek solutions on pests and diseases problems in field and horticultural crops.
- Pamphlets containing technology package both in English and Tamil versions were been brought out by this Kendra for effective utilisation by the end user.

Table 2. Activities of KVK for promoting IPM in major crops

Year	Farm advisory service	Guest lectures	Method demonstrations	Number of farmers visited
1997-98	26	63	04	172
1998-99	38	116	06	263
1999-00	39	120	02	150
2000-01	46	123	02	241
2001-02	42	95	02	220
2002-03	38	67	02	247
2003-04	40	116	03	242
2004-05	66	120	02	247
2005-06	57	127	04	223
2006-07	78	124	04	271
Total	470	1071	31	2276

Farmers' Field School (FFS)

Farmers Field School is a school without walls, where in farmers' fields provide the learning experience throughout the crop growing period. Farmers' Field Schools were conducted by the Department of Agriculture from the year 1994 95 onwards for various crops like paddy, groundnut and cotton. These Schools were conducted in a particular day of every week. The farmers were divided into five groups of six each and an extension functionary supervised each group.

Farmers could master the skills to identify and assess the pest and beneficial insects' population, based on which, they were able to arrive at various pest management strategies in different stages of the crop. The data on the number of Farmers Field Schools conducted in Pondicherry region from 1994-95 to 2006-07 in various crops were given in Table 3. The KVK personnel have conducted 182 FFS on paddy, groundnut and cotton in various villages.



Table 3. Farmers Field Schools conducted in Pondicherry region by the Department of Agriculture with the technical guidance of the KVK

Sl. No	Year	Crop	No. of FFS conducted	No. of farmers
1	1994-95	Paddy	4	120
2	1995-96	Paddy	8	240
3	1996-97	Paddy	8	240
		Cotton	4	120
4	1997-98	Paddy	8	240
5	1998-99	Paddy	25	750
		Groundnut	8	240
6	1999-00	Paddy	14	420
		Groundnut	8	240
7	2000-01	Paddy	10	300
		Groundnut	8	240

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8	2001-02	Paddy	8	240
		Groundnut	8	240
9	2002-03	Paddy	16	480
		Groundnut	8	240
10	2003-04	Paddy	13	390
11	2004-05	Paddy	8	240
12	2005-06	Paddy	8	240
13	2006-07	Paddy	8	240
Total			182	5460

FFS in Paddy: 138, FFS in Cotton: 4, FFS in Groundnut: 40

Frontline Demonstration

Groundnut is one of the oilseed crops grown in an area of about 1200 ha. in Pondicherry region every year. Research findings revealed the scope for increasing the yield of oilseed crops especially groundnut. Front line demonstrations (FLD) were conducted to demonstrate the productivity potential of the latest improved oilseed crop production technologies, including IPM, recommended for different agro-ecological situations vis-à-vis prevailing farming practices.

During the period between 1998-99 and 2006-07, FLD on groundnut were conducted in an area of 65 hectare involving 155 farmers (Table 4a). Similarly during the period 2002-03 to 2006-07 FLD on blackgram were conducted in an area of 50 ha covering 50 farmers (Table 4b). The IPM concept was emphasised through method demonstrations. Problems tackled under this demonstration were chosen through Participatory Rural Appraisal and steps were taken to educate the farmers regarding the improved technologies and skills involved in IPM.

Table 4a. Promoting IPM concept through Front line demonstration in groundnut

Year	Villages	Area (ha)	No. of farmers
1998-99	Odiyampet	5	7
1999-00	Eripakkam, Sompattu, Kombakkam	5	11
2000-01	Odaveli, Thavalakuppam Karikkalampakkam	5	8
2001-02	Sellipattu	5	13
2002-03	Eripakkam, Kariamanickam	10	28
2003-04	Embalam	10	25
2004-05	Kuruvinatham, Thondamanatham	10	25
2005-06	Thondamanatham, Koodapakkam, Ramanathapuram and Pillaiarkuppam	10	25
2006-07	Karikalampakkam	05	13
Total		65	155

Table 4b. Promoting IPM concept through Front line demonstration in blackgram

Year	Villages	Area (ha)	No. of farmers
2002-03	Madagadipet, Andiarpalayam, Silukaripalayam, Kothapurinatham and Thirubhuvanai	05	13
2004-05	Sompattu, Arumbarthapuram and Odiampattu	05	12
2005-06	Silukaripalayam and M.Kuchipalayam	05	12
2006-07	Ariyur	05	13
Total		20	50

Linkage

The need for inter-disciplinary approach and multi-organisational collaboration in tackling various problems, especially the pests and diseases, encountered by the farmers in the production of food grains, vegetables, fruits and flowers were well taken care of by the KVK through its active involvement alongwith various other institutions and developmental departments.

This Kendra established effective linkage with several developmental departments/research institutions for performing the regular activities in an appropriate manner. The nature of linkage provided by these organisations is described in Table 5. Recent developments and advances in the fields of entomology and pathology that provide relevant technological support for crop protection / pest management / IPM / biological suppression could be made known to the farming community through these linkages.

Table 5. Nature of linkage established by the KVK to promote IPM strategies

Sl.No.	Name of the organisation	Nature of linkage
1	Project Directorate of Biological Control, ICAR, Bangalore	Technical guidance and consultancy for multiplication of biocontrol agents
2	Indian Institute of Horticultural Research, ICAR, Bangalore	IPM technologies in vegetables, flowers and fruit crops
3	Tamil Nadu Agricultural University, Coimbatore	Advances on IPM in field crops
4	Sugarcane Research Station, Cuddalore	Information on IPM in Sugarcane
5	Vegetable Research Station, Palur	Information on IPM in vegetable crops
6	Oilseeds Research Station, Tindivanam	Technologies on IPM in oil seed crops
7	Oilseeds Research Station, Vridhachalam	Information on IPM in oilseed crops
8	Faculty of Agriculture, Annamalai University, Annamalainagar	Resource personnel for training programme on IPM at KVK
9	College of Agriculture and Research Institute, Karaikal.	Resource personnel for training programme on IPM
10	Directorate of Rice Research Hyderabad	Technology and material for IPM trials in paddy
11	Department of Agriculture, Pondicherry	Disseminate IPM technologies to extension officials in Zonal Workshops
12	Pondicherry University,	Technical support for Bio-Control Laboratory
13	Vector Control Research Centre, Pondicherry	Testing the quality of bio pesticides

Impact Indicators

Apart from imparting training, conducting demonstrations, rendering farm advisory services for effective transfer of IPM technology, the innovation diffusion process was also supported by the production and distribution of various bio agents by the Kendra. Impact of the efforts of the KVK in popularising IPM technologies have been brought out by using various indicators like increased demand and supply of biological agents and products, reduction in pesticide consumption, reduced cost of production and increased farm income.

Production and distribution of biocontrol agents

The Biocontrol Laboratory was established in the year 1997 in the KVK with the technical consultancy offered by the Project Directorate of Biological Control, ICAR, Bangalore. The laboratory had been functioning consistently, an indicator of its commitment to the production and supply of biocontrol agents to the farming community.



Trichogramma japonicum (Ashmead) (an egg parasitoid entomophage) was taken up for mass multiplication since March 21st 1999 to commemorate the Silver Jubilee Celebrations of KVK, Pondicherry. This was followed by *Trichogramma chilonis* Ishii (egg and larval parasitoid), as these parasitoids have quick and swift action against the target pests.

The laboratory was also equipped to produce and develop other bio- agents viz. *Pseudomonas fluorescens* (bacterial bio-pesticide) and *Trichoderma harzianum* & *Trichoderma viridi* (Antagonistic fungal bio-pesticides) in 2001-02. Nuclear Polyhedrosis Virus (viral bio-pesticide) for *Spodoptera litura* (Fabricius) was produced and made available to the farming community from January 2004.

The data in Table 6 indicate the supply of various biocontrol agents including entomophages and bio-pesticides to the farming sector with the coverage of different crops in this region during the years 1999-00 to 2006-07. It could be seen that the coverage of area under biological control in the IPM programme for the prudent suppression of various crop pests and diseases is increasing every year.

Since the establishment of the Biocontrol laboratory, about 7786 cc of *Trichogramma japonicum* (Ashmead) strain to contain the problems of rice stem borer and 25303 cc of *Trichogramma chilonis* Ishii for the suppression of rice leaf folder, sugarcane borers, fruit borers in vegetables like brinjal, Bendi, tomato and chillies, groundnut leaf feeder and cotton bollworms have been supplied to the farming community. Similarly 401.67 litres of Nuclear Polyhedrosis Virus (NPV) have been provided to the groundnut and cotton growers to curb the menace due to tobacco caterpillar *Spodoptera litura* (Fabricius). Besides, 36862 kgs *Pseudomonas fluorescens* (Bacterial bio-pesticide) had been distributed to control various rice diseases like blast, sheath blight, sheath rot, bacterial leaf blight and banana wilt. In addition, about 5890 kg of *Trichoderma harzianum* as well as 7086 kg *T. viridi* were distributed for the management of root rot, root wilt diseases of cotton, groundnut and pulses and also for damping off disease in vegetable crops.

Table 6. Production and supply of various bioagents to the farmers

Sl. No	Entomophage/ Biopesticide	Year	Quantity supplied	Area (ha)	Crops	Target pests/diseases
1	<i>Trichogramma japonicum</i> (Ashmead) (Egg Parasitoid)	1999-00	239 cc	47.8	Paddy and sugarcane	Paddy stem borer sugarcane top borer
		2000-01	274 cc	54.8		
		2001-02	1047 cc	209.4		
		2002-03	1147 cc	229.4		
		2003-04	1018 cc	203.6		
		2004-05	1631 cc	326.2		
		2005-06	1009 cc	201.8		
		2006-07	1421 cc	284.2		
	Total	7786 cc	1557.2			
2	<i>Trichogramma chilonis</i> Ishii (Egg & Larval Parasitoid)	1999-00	203 cc	40.6	Paddy, sugarcane, cotton, groundnut vegetables	Paddy leaf folder, sugarcane early shoot borer and inter-node borer, groundnut leaf feeder, cotton bollworms, vegetables - fruit and shoot borers
		2000-01	1149 cc	229.8		
		2001-02	3061 cc	612.2		
		2002-03	3111 cc	622.2		
		2003-04	4004 cc	800.8		
		2004-05	4725 cc	945.0		
		2005-06	4050 cc	810.0		
		2006-07	5000 cc	1000.0		
	Total	25303 cc	5060.6			

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Sl. No	Entomophage/ Biopesticide	Year	Quantity Supplied	Area (ha)	Crops	Target pests/diseases
3	Nuclear Polyhedrosis Virus (NPV) for <i>Spodoptera litura</i>	2003-04	60.55 lts	96.9	Groundnut, cotton, pulses, chillies banana	Leaf feeder – <i>Spodoptera litura</i> (Fabricius)
		2004-05	118.77 lts	190.0		
		2005-06	120.60 lts	192.9		
		2006-07	101.75 lts	162.8		
		Total	401.67 lts	642.6		
4	<i>Pseudomonas fluorescens</i> (Bacterial Biopesticide)	2001-02	2023 kg	1000.0	Paddy and banana	Paddy - sheath blight, sheath rot, blast and bacterial leaf blight. <i>Helminthosporium</i> leaf spot and Panama wilt in banana
		2002-03	5006 kg	3200.0		
		2003-04	6256 kg	3102.4		
		2004-05	7241 kg	3620.5		
		2005-06	8316 kg	4158.0		
		2006-07	8020 kg	3990.0		
Total	36862 kg	19070.9				
5	<i>Trichoderma harzianum</i> (Antagonistic Fungal Biopesticide)	2001-02	520 kg	500.0	Cotton, groundnut, pulses vegetables	Groundnut root rot, pulses root wilt, cotton wilt and vegetables - damping off, root wilt and root rot
		2002-03	1016 kg	560.0		
		2003-04	-	-		
		2004-05	600 kg	500.0		
		2005-06	1487 kg	750.0		
		2006-07	2267 kg	907.0		
Total	5890 kg	3217.0				
6	<i>Trichoderma viridi</i> (Antagonistic Fungal)	2002-03	1000 kg	560.0	Cotton, groundnut, pulses	Groundnut root rot, pulses root wilt, cotton wilt and Vegetables - damping off root wilt
		2003-04	1112 kg	600.0		

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Fungal Biopesticide)	2004-05	1483 kg	741.0	vegetables	damping off, root wilt and root rot
	2005-06	938 kg	470.0		
	2006-07	2553 kg	1021.0		
	<i>Total</i>	7086 kg	3392.0		

Demand for biocontrol agents

There is an increase in the use of biological agents to manage pests by the farmers. Among the bio-agents, entomophages and bio-pesticides were effective against a number of insect pests and hence preparations of them were now finding a place in the commercial markets.

The KVK had been extending all the possible services to the farming community by distributing various bio-control agents in addition to their mass production, which was a cumbersome task involving the identification, collection, culturing, formulation, packaging, standardisation and marketing

Reduction in pesticide consumption and number of pesticide dealers

Use of different forms of pesticides against the burgeoning insect pest populations during the past three decades had culminated in wide range of environmental pollution one with disastrous effects on all the living organisms. Keeping this in view, the farmers of Pondicherry region were motivated to use the IPM practices for managing the crop pests and diseases. As a result consumption of pesticides in Pondicherry had come down significantly from 135 MT of technical grade pesticides in 1994-95 to 40.77 MT in 2006-07, i.e. about 70% reduction in the pesticide consumption.

It may be seen from the data that in-spite of the periodical occurrence of pests and diseases over the years (Table 7) the pesticide off-take is getting reduced (Table 8). This demonstrates the tendency of the farmers in adopting IPM methods of crop protection rather than the usage of chemical pesticides. Similarly, the number of pesticide outlets had decreased from 209 in 1996-97 to 110 in 2006-07, nearly 47 percent decrease. The lowest number of outlets was recorded in 2006-07. This confirms that the farmers of Pondicherry region have realised the ill effects of pesticides usage. They were also convinced with the effectiveness and efficiency of alternate methods available in IPM strategy to combat the insect pests and diseases while obtaining good quality and pesticide free products at lower cost of cultivation.

Table 7. Occurrence of pests and diseases (%) in Pondicherry (1998-2003)

Year	Thrips	Jassids	Yellow stem borer	Leaf folder	Ear head bug	Sheath rot	Bacterial leaf blight
1998	15.0	17.5	10.0	10.0	-	25.0	25.0
1999	20.0	20.0	7.5	13.0	10.0	20.0	25.0
2000	21.3	23.3	7.0	10.8	10.0	25.0	20.0
2001	23.3	23.3	7.5	11.7	5.0	25.0	25.0
2002	21.3	21.3	5.0	11.3	5.0	20.0	18.0
2003	18.8	17.5	12.1	6.8	2.0	5.0	20.0
2004	19.2	17.7	6.0	12.3	2.3	5.2	20.4
2005	18.9	16.8	6.2	11.7	2.0	3.8	24.3
2006	18.5	16.9	7.4	12.8	3.2	5.0	24.1

Table 8. Area under paddy and groundnut, consumption of pesticides and number of pesticide outlets in Pondicherry

S.No.	Year	Area under paddy (ha)	Area under groundnut (ha)	Consumption of pesticides (tonnes)	No. of pesticide outlets
1	1994-95	13624	4409	135.00	181
2	1995-96	12771	3795	119.40	187
3	1996-97	13135	3213	96.12	209
4	1997-98	12791	2781	82.05	196
5	1998-99	15684	2519	72.75	195
6	1999-00	15008	2021	70.30	201
7	2000-01	16352	1940	64.11	149
8	2001-02	16460	1994	58.10	125
9	2002-03	15529	1615	49.95	135
10	2003-04	15274	1977	46.95	130
11	2004-05	16000	1790	43.28	132
12	2005-06	15702	1658	40.77	133
13	2006-07	14914	1104	40.77	110

Reduction in cost of plant protection

A study was conducted at Odiyampet village of Villianur commune to know about the impact of KVK's role in popularisation of IPM practices. The study revealed that the farmers of Odiyampet village having learnt about the Agro Eco-System Analysis (AESAs), Economic Threshold Level (ETL) of pests, beneficial insects available in the field and the IPM technologies to be followed, could curtail the use of plant protection chemicals by following IPM practices.

Neem oil, neem cake, Tricho cards, light trap, pheromone trap and 'T' shaped bird perches have been used (Table 9) and were instrumental in bringing down the expenses towards the plant protection apart from getting quality produce. It is evident that the farmers could save more than Rs.1800 per acre towards plant protection (down from Rs 2438 to Rs 625) by following IPM methods advocated by this KVK.

Table 9. Reduction in cost of plant protection due to IPM methods in paddy

S.No	Name of the farmers of Odiyampet village	Cultivated area (ha)	Cost of plant protection (Rs/ha)		IPM practices followed
			Before IPM	With IPM	
1	Venkatachalam	2.8	2250	625	Neem oil 'T' shaped bird perches
2	Srinivasan	1.2	2500	750	Neem oil, Light trap 'T' shaped bird perches
3	Balaraman	0.8	2000	625	Tricho cards 'T' shaped bird perches
4	Perumal	1.2	2375	688	Neem oil,
5	Ezhumalai	1.2	2500	625	'T' shaped perches
6	Thiruvengadam	1.2	2500	375	Pancha kaviya
7	Venkatasamy	1.6	2438	563	Tricho cards, neem oil
8	Radhakrishnan	10.0	2500	625	Neem oil, Tricho cards 'T' shaped bird perches
9	Baskar	1.2	2750	750	Neem oil, Tricho cards
10	Kumarakrishnan	6.0	2500	650	Neem oil, Tricho cards 'T' shaped bird perches
Average		2.7	2431	628	

With the adoption of IPM, the paddy farmers could earn a net income of Rs 16875/hectare, which was Rs. 5688 more than their income before they started adopting the IPM package (Table 10).

Table 10. Economics of paddy production before and after adoption of IPM practices at Odiyampet village

Situation	Yield (t/ha)	Gross income (Rs/ha)	Cost of pest management (Rs)	Other costs (Rs)	Total cost (Rs)	Net income (Rs/ha)
Before IPM	6.6	21875	2438	8250	10688	11187
After IPM	6.6	35000	625	17500	18125	16875

CONCLUSION

Efforts of the KVK in popularising the IPM concept have created significant changes at the farmers level as well as at the pesticides industry level. Comprehensive and holistic efforts of the KVK in the form of training, front line demonstration and field visits and its technical support to the Farmers' Field Schools conducted by the Department of Agriculture of Pondicherry have been responsible for all this.

In addition to the knowledge and skill building exercises, production and supply of bio-products and bio-agents through its Bio-control Laboratory have played a crucial role in transforming the changed mindset of the farmers into actual practice. Another significant factor is that repeated emphasis was given about the IPM methods not only in the trainings conducted exclusively for IPM but also in the other crop production trainings, demonstrations, and farmers' visits to the KVK. Technical support and training given to the extension functionaries have supplemented the KVK efforts, thus creating a multiplier effect to popularise IPM strategies in Pondicherry.

[BACK](#)