Principle Knowledge of Integrated Pest Management Adopting Cotton Cultivators in Irrigated and Rainfed Conditions: A Critical Analysis

B. Sudhakar, K. A. Ponnusamy

Abstract— In India cotton was the major commercial crop and cultivating all the states. In recent years, area of cotton declined due to pest and disease attack, drought, lower price for the produces etc. The first reason as pest and disease attack will be the challenges and it is of utmost importance that in future the insect problems would have to be tackled through Integrated Pest Management (IPM). The present study deals with principle knowledge of IPM adopting cotton cultivators in irrigated and rainfed conditions. Under irrigated conditions, among cultural practices, all respondents had principle knowledge about growing high yielding and pest resistant hybrids, sowing quality and certified seeds and avoiding cotton ratoon cropping. Regarding mechanical practices all respondents had principle knowledge about collecting and destroying egg, larvae and pupae of pests and removing and destroying pest and disease infected cotton squares, flowers and other shed materials. With regard to biological practices, 93% of them had principle knowledge about spraying neem oil, followed by 82% about tying *Trichogramma eggcard*. Among chemical practices, more than 90% of the respondents had principle knowledge about of spraying herbicide (96%), identifying ETL (Economic Threshold Level) for cotton pests (94%), and applying safe insecticides (90%). Under rainfed condition, among cultural practices, all respondents had principle knowledge about sowing quality and certified seeds and growing high yielding and pest resistant hybrids seeds. Regarding mechanical practices hundred percentage of the respondents had principle knowledge on the mechanical practices *viz.*, collecting and destroying egg, larvae and pupae of pests and removing and destroying pest and disease infected cotton squares, flowers and other shed materials. With regard to biological practices, 96% of the respondents had correct in principle knowledge about spraying neem oil, followed by 89% about tying *Trichogramma eggcard*. With regard to chemical practices, more than 90% of the respondents had principle knowledge of applying safe insecticides (95%), avoiding repeated use of the same insecticides (95%), identifying ETL for cotton pests (94%) and applying granular insecticides (90%).

Keywords—Biological practices, chemical practices, cultural practices, mechanical practices, integrated pest management.

I. INTRODUCTION

COTTON, the 'White Gold' and 'King of Fibres' is a crop of prosperity and is considered to be an industrial commodity of worldwide importance. It is an important fibre crop of global significance, cultivated in tropical and sub-tropical regions of around 80 countries such as USA, China, India, Pakistan, Uzbekistan, Argentina, Australia, Greece, Brazil, Mexico and Turkey. The cotton productivity in India is abysmally low as compared to many other countries including our neighbor Pakistan [1]. Under the impact of green revolution, introduction of hybrid seeds and mono-cropping, there have been many outbreaks of insect pests especially on rice and cotton. In recent years the area and production of cotton in Tamil Nadu State in India are reducing due to outbreaks of pest and diseases, environmental pollution, insecticide resurgence by pest etc. To rectify the pest and disease problem in cotton is through IPM. IPM has been defined as the integrated use of some or all the pest control strategies in a way that not only reduce pest population to economically acceptable levels but it is sustainable and non-polluting [1]. The IPM programme aims at educating the farmers and extension agencies through Farmers Field Schools (FFS). Under FFS programme, farmers are made experts in identifying natural enemies of pests, monitoring regular pests and taking suitable management measures. In 1999-2000 under ICDP (Intensive Cotton Development Programme) totally 1500 FFS were organized and 45000 cotton growers were trained throughout India [3]. There is urgent need for to studying the principle knowledge of IPM farmers in irrigated and rainfed conditions. Principle knowledge consists of information dealing with functioning principles underlying how the innovation works. Knowledge is defined as knowing about the concept, types of innovations but not know the principles underlying how the innovation works [4].

II. LITERATURE REVIEW

There was a limited review available with relevant to principle knowledge studies. Here some reviews are listed.

Among the cotton farmers, 40% possessed low and medium levels of knowledge on cotton technologies and 14% were found to have higher level of knowledge on cotton technologies [5].

In the study on factors influencing knowledge of cotton growers about integrated pest management practices in cotton in Amaravathi district of Maharashtra and revealed that 67.77% of the farmers had medium level of knowledge about IPM practices in cotton whereas almost an equal percentage of respondents had low (15.76%) and high (16.97%) knowledge level [6].

In the study on knowledge and adoption of IPM practices among cotton growers of Raichur District, it is concluded that 58% of the respondents had low level of knowledge of IPM

B. Sudhakar is Assistant Professor with the Dept. of Agril. Extension, Annamalai University, Tamil Nadu, India (e-mail: ban_sudh@rediffmail.com).

K.A. Ponnusamy is Retired professor with the Dept. of Agrl. Extension and Rural Sociology, TNAU, Coimbatore, Tamil Nadu, India.

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practices of cotton crop while 34% of them had medium and only 8% of them had high level of knowledge [7].

The study on knowledge and adoption of sustainable cultivation practices in sugarcane and cotton by farmers in Cuddalore district of Tamil Nadu reported that 66.25% of the farmers had medium knowledge level followed by 17.50% with high knowledge level and 16.25% with low level about sustainable cultivation practices in cotton [8].

In the study on knowledge of farmers on cotton production technologies in Malaprabha command area revealed that 69% of the respondents had medium level of knowledge of cotton production technologies followed by 17% high knowledge, whereas 14% of respondents had low level of knowledge [9].

III. RESEARCH METHODOLOGY

Coimbatore district in Tamil Nadu State of India stands first in total number of IPM-FFS training programmes conducted for cotton throughout the Tamil Nadu State over the years and hence, it was selected for the study [5]. The highest area under cotton and maximum number of IPM-FFS training programmes conducted were considered as the criteria to select the Taluk representing irrigated and rainfed conditions. The same criteria were used for selection of Block where Madukarai block under irrigated condition and Avinashi block under rainfed condition were selected. In Madukarai block, four villages were selected for irrigated condition and in Avinashi block; four villages were selected for rainfed condition. A sample of 100 farmers for irrigated condition and 100 farmers for rainfed conditions of those who completed IPM-FFS training was selected for the study. The objective of the study was founding the IPM oriented cotton growers' principle knowledge under irrigated and rainfed conditions. Principle knowledge consists of information dealing with functioning principles underlying how the innovation works [6]. The list of items that would help to measure the principle knowledge on recommended IPM technologies were prepared in consultation with entomologist, extension scientists and by referring to the IPM-FFS Guide. The items were categorized into cultural, mechanical, biological and chemical practices. The responses were collected on a two-point continuum of "correct" and "incorrect". Percentage analysis was worked out to study the practice-wise principle knowledge of respondents on IPM practices.

IV. FINDINGS AND DISCUSSION

The distribution of cotton growers according to practice-wise principle knowledge under irrigated and rainfed conditions is presented in Tables I and II.

Under cultural practices, it is seen from Table I that under irrigated condition, all of the respondents had correct in principle knowledge on the cultural practices *viz.*, growing high yielding and pest resistant hybrids, sowing quality and certified seeds and avoiding cotton ratoon cropping practices. This was followed by 91% and 74% of the respondents with principle knowledge on applying neem cake and applying FYM/Compost respectively. About 66% of the respondents

were correct in treating seed with *azospirillum* bio-fertilizer followed by 64% growing intercrops like blackgram and greengram, 62% treating seed with fungal bioagent: *Trichoderma* and 60% growing same hybrid throughout the village.

TABLE I
PRACTICE-WISE PRINCIPLE KNOWLEDGE OF IPM PRACTICES UNDER
IRRIGATED CONDITION

Practices	Principle Knowledge	
I Cultural Practices	Correct (%)	Incorrect (%)
Growing high yielding and pest resistant hybrids	100	0.00
Sowing quality and certified seeds	100	0.00
Avoiding cotton ratoon cropping practices	100	0.00
Applying neem cake	91.00	9.00
Applying FYM (Farm Yard Manure)/Compost	74.00	26.00
Treating seed with *azospirillum* bio-fertilizer	66.00	34.00
Growing intercrops like blackgram and greengram	64.00	36.00
Treating seed with fungal bioagent: *Trichoderma*	62.00	38.00
Growing same hybrid throughout the village	60.00	40.00
Summer ploughing	57.00	43.00
Sowing cotton seed by ridges and furrow method	52.00	48.00
Growing trap crops like sunflower and marigold	43.00	57.00
Acid delinting of cotton seeds	42.00	58.00
Growing bund crops like maize, cumbu and castor	38.00	62.00
Following alternate furrow method of irrigation	30.00	70.00
Treating seed with mixture of *Trichoderma* and *Pseudomonas* fungal bioagents	26.00	74.00
Seed hardening with pungam leaf extract	14.00	86.00
II Mechanical Practices		
Collecting and destroying egg, larvae and pupae of pests	100	0.00
Removing and destroying pest and disease infected cotton squares, flowers and other shed materials	100	0.00
Fixing light traps	63.00	37.00
Fixing sex pheromone traps	60.00	40.00
Clipping the terminal portion of main stem	59.00	41.00
Fixing yellow sticky traps	57.00	43.00
Fixing 'T' shaped poles in the cotton field	35.00	65.00
Covering dark blue cloths in the field	19.00	81.00
III Biological Practices		
Spraying neem oil	93.00	7.00
Tying *Trichogramma* egg cards	82.00	18.00
Releasing the predatory Reduvid bug	65.00	35.00
Spraying viral bio-control agent: NPV (Nuclear Poly-Hedrosis Virus)	59.00	41.00
Spraying bacterial biocontrol agent thuricide: Bt (*Bacillus thuringensis*)	38.00	62.00
Spraying pungam oil	27.00	73.00
Releasing the predator *Chrysopa*	20.00	80.00
Releasing the egg, larval parasitoid : *Chelonus Blackburni*	11.00	89.00
IV Chemical Practices		
Spraying herbicide	96.00	4.00
Identifying ETL for cotton pests	94.00	6.00
Applying safe insecticides	90.00	10.00
Avoiding repeated use of the same insecticides	88.00	12.00
Applying granular insecticides	87.00	13.00
Applying correct quantity of pesticides	78.00	22.00
Spraying neem based insecticide: *Azadirachtin*	54.00	46.00
Spraying chemicals in evening hours	33.00	67.00

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Practices	Principle Knowledge	
I Cultural Practices	Correct (%)	Incorrect (%)
Sowing quality and certified seeds	100.	0.00
Growing high yielding and pest resistant varieties	100	0.00
Avoiding cotton ratoon cropping practices	96.00	4.00
Applying neem cake	90.00	10.00
Growing same variety thoughout the village	75.00	25.00
Treating seed with *azospirillum* bio-fertilizer	68.00	32.00
Treating seed with fungal bioagent : *Trichoderma*	65.00	35.00
Growing intercrops like blackgram and greengram	62.00	38.00
Applying FYM	58.00	42.00
Growing trap crops like sunflower and Marigold	47.00	53.00
Growing bund crops like maize, cumbu and Castor	43.00	57.00
Summer ploughing	42.00	58.00
Acid delinting of cotton seeds	20.00	80.00
Treating seed with mixture of *Trichoderma* and *Pseudomonas* fungal bioagents	17.00	83.00
Sowing cotton seed by ridges and furrow method	11.00	89.00
Seed hardening with pungam leaf Extract	8.00	92.00
II Mechanical Practices		
Collecting and destroying egg, larvae and pupae of pests	100	0.00
Removing and destroying pest and disease Infected cotton squares, flowers and other shed materials	100	0.00
Fixing 'T' shaped poles in the cotton field	78.00	22.00
Fixing yellow sticky traps	65.00	35.00
Fixing light traps	64.00	36.00
Fixing sex pheromone traps	58.00	42.00
Clipping the terminal portion of main stem	43.00	57.00
Covering dark blue cloths In the field	29.00	71.00
III Biological Practices		
Spraying neem oil	96.00	4.00
Tying *Trichogramma* egg cards	89.00	11.00
Spraying viral bio-control agent: NPV(Nuclear Poly-Hedrosis Virus)	66.00	34.00
Releasing the predatory Reduvid bug	60.00	40.00
Releasing the predator *Chrysopa*	48.00	52.00
Spraying bacterial biocontrol agent thuricide: Bt (*Bacillus thuringensis*)	47.00	53.00
Spraying pungam oil	15.00	85.00
Releasing the egg, larval parasitoid : *Chelonus Blackburni*	9.00	91.00
IV Chemical Practices		
Applying safe insecticides	95.00	5.00
Avoiding repeated use of the same Insecticides	95.00	5.00
Identifying ETL (Economic Threshold Level) for cotton pests	94.00	6.00
Applying granular insecticides	90.00	10.00
Applying correct quantity of pesticides	80.00	20.00
Spraying herbicide	62.00	38.00
Spraying neem based insecticide: *Azadirachtin*	48.00	52.00
Spraying chemicals in evening hours	24.00	76.00

It is seen from Table II that under rainfed conditions, all of the respondents had principle knowledge on the cultural practices *viz.*, sowing quality and certified seeds, growing high yielding and pest resistant hybrids. This was followed by more

than 60% of respondents had correct in principle knowledge about growing same variety throughout the village, treating seed with *azospirillum* bio-fertilizer treating seed with fungal bioagent; growing intercrops like blackgram and greengram.

Under mechanical practices, Table I also reveals that under irrigated condition all respondents had correct in principle knowledge on the mechanical practices *viz.*, collecting and destroying egg, larvae and pupae of pests and removing and destroying pest and disease infected cotton squares, flowers and other shed materials. Nearly 60% of the respondents had correct in principle knowledge of fixing light and pheromone traps. More than 60% of farmers had principle knowledge on fixing light traps and sex pheromone traps This might be due to most of the mechanical practices are simple and easily understood by the cotton growers under IPM-FFS training programmes. Table II also reveals that under rainfed condition all respondents had correct in principle knowledge on the mechanical practices *viz.*, collecting and destroying egg, larvae and pupae of pests and removing and destroying pest and disease infected cotton squares, flowers and other shed materials. 78% of the respondents had correct in principle knowledge on fixing 'T' shaped poles in the cotton field. More than 60% of the respondents had correct in principle knowledge on fixing yellow sticky traps and light traps.

Biological practices from Table I indicate that under irrigated condition, with respect to biological practices, 93% of the respondents had correct in principle knowledge about spraying neem oil, followed by 82% about tying *Trichogramma* eggcard. More than 80% of the respondents did not have principle knowledge about releasing the egg, larval parasitoid: *Chelonus blackburni* and releasing the predator *Chrysopa*.

Table II indicates that under rainfed condition, with respect to biological practices, 96% of the respondents had correct in principle knowledge about spraying neem oil, followed by 89% about tying *Trichogramma* eggcard. More than 80% of the respondents did not have principle knowledge about spraying pungam oil and releasing the egg, larval parasitoid: *Chelonus blackburni*.

Chemical practices from Table I indicate that under irrigated condition, more than 90% of the respondents had correct in principle knowledge of spraying herbicide (96%), identifying ETL for cotton pests (94%), and applying safe insecticides (90%). More than 80% of the respondents had correct in principle knowledge of the practices *viz.,* avoiding repeated use of the same insecticides (88%) and applying granular insecticides (87%). 67% of the cotton farmers not had principle knowledge of spraying chemicals in the evening hours.

Table II indicates that under rainfed condition as for as chemical practices were concerned, more than 90% of the respondents had correct in principle knowledge of applying safe insecticides (95%), avoiding repeated use of the same insecticides (95 %), identifying ETL for cotton pests (94%) and applying granular insecticides (90%). 80% of the respondents were correct in principle knowledge of applying

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correct quantity of pesticides followed by 62% spraying herbicide.

V. CONCLUSION

Coimbatore district of Tamil Nadu state is one of the cotton belts in India and the State Department of Agriculture gave importance for giving training to cotton farmers on IPM practices. The farmers also followed and applied the knowledge and principles on IPM practice to the field in order to control the pest and diseases and increase their yield and profit. From this study, it is concluded that the majority of the respondents under irrigated and rainfed condition had correct in principle knowledge on IPM practices. Under irrigated condition, among cultural practices more than two-third of respondents had principle knowledge about most of the IPM practices. Regarding mechanical practices more than 60% of respondents had principle knowledge of five among eight IPM practices. With regard to biological practices, more than 60% of respondents had incorrect in principle knowledge of four among eight IPM practices. Among chemical practices, more than 80% of respondents had principle knowledge of six among eight IPM practices. In rainfed condition, among cultural practices more than two-third of respondents had principle knowledge about most of the IPM practices. Regarding mechanical practices more than 60% of respondents had principle knowledge of five among eight IPM practices. With regard to biological practices, more than 60% of respondents had incorrect in principle knowledge of four among eight IPM practices. Among chemical practices, more than 80% of respondents had principle knowledge of six among eight IPM practices. It may be concluded that the principle knowledge on cultural practices of the respondents under both irrigated and rainfed conditions were similar. Higher percentage of respondents under rainfed condition had principle knowledge about fixing "T" shaped poles in the cotton field might be due to the necessity of control of the larvae by birds sitting on these poles.
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