Adoption of Integrated Pest Management (IPM) in Vegetables: A case of onion in Tamil Nadu

N. Kiruthika
Department of Agricultural Economics
Tamil Nadu Agricultural University,
Coimbatore
India

Abstract: The need for pesticide free agriculture is multidimensional. But alternative pest control technologies available at present are not very successful and popular among the farmers in different production environments and across crops. Hence the study has examined the awareness and adoption of Integrated Pest Management (IPM) practices on onion in Tamil Nadu. For the present study, three stage stratified sampling was used to select the study area. Data were collected from 264 randomly selected farmers growing the onion. There was significant gap between awareness and adoption of IPM practices for different crops. The results indicated that though the awareness index was 12.12, the adoption index was only 8.52, which shows only that 75 percent of the technology generated was adopted in the field.

Keywords: Pesticide use, awareness, adoption, onion and integrated pest management (IPM)

I. Introduction

Insect pests, diseases, and weeds are the major factors limiting agricultural productivity growth. Pest problem is one of the major deterrents for achieving higher production in agriculture crops. It is estimated that herbivorous insects eat about 26 percent of the potential food production. India loses about 30% of its crops every year due to pests and diseases [1]. The insect pests inflict crop losses to the tune of 40 percent in vegetable production [2]. The production losses have shown an increasing trend over the years. In 1983, the losses due to insect pests were estimated worth Rs 6,000 crores [3] which increased to Rs 20,000 crores in 1993 [4] and to 29,000 crores in 1996 [5]. Use of chemical inputs such as pesticides has increased agricultural production and productivity. The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, plant growth regulators and others. In India, pesticide use has increased at an annual rate of 2.5 percent since early 1970s. Pesticide use in India increased from a mere 15 g/ha of gross cropped in 1955-56 to 90 g/ha in 1965-66. Introduction of green revolution technologies in mid-1960s gave a fillip to pesticide use, and in 1975-76, it had increased to 266 g/ha, and reached a peak of 404 g/ha in 1990-91 [6]. About 96,000 tonnes of technical grade pesticides are currently produced in the country, of which two-thirds are used in agriculture [7]. The adoption of high yielding cereal varieties led to a manifold increase in crop yields. Maintaining higher yields also led to a dramatic increase in pesticide use; from 5,700 tonnes in 1960 to 46,195 tonnes in 2000. Although per hectare pesticide use in India is about 250g, pesticides are used indiscriminately [5]. The correct use of pesticides can deliver significant socioeconomic and environmental benefits in the form of safe, healthy, affordable food; and enable sustainable farm management by improving the efficiency with which we use natural resources such as soil, water and overall land use. For all pesticides to be effective against the pests they are intended to control, they must be biologically active, or toxic. Because pesticides are toxic, they are also potentially hazardous to humans, animals, other organisms, and the environment. Continuous use of chemical inputs such as pesticides has resulted in damage to the environment, caused human ill-health, negatively impacted on agricultural production and reduced agricultural sustainability. Fauna and flora have been adversely affected. Numerous short- and long-term human health effects have been recorded. Human deaths are not uncommon. The decimation of beneficial agricultural predators of pests has led to the proliferation of several pests. There is an urgent need to find viable alternatives to pesticides so as to minimize the pesticide residues. According to the noted agricultural scientist, M.S. Swaminathan [8], agriculture production systems in the 21st century need to be based on the appropriate use of biotechnology, information technology, and eco-technology. Integrated Pest Management (IPM) is one such technology.
There should be promotion of IPM practice which is an eco-friendly approach which employs available alternate pest control methods such as mechanical, biological control with greater emphasis on use of crop rotation, biopesticides and plant origin pesticides like neem formulations to keep pest population low. Pesticides should be used only when pest population crosses economic threshold level. The onion is an important vegetable and has been grown in almost all the parts of India for thousands of years. Onions are regarded as a highly export-oriented crop and earn valuable foreign exchange for the country. Though India produces a significant quantity of onions it is not regular and sufficient enough to meet the demands for both domestic requirement and exports. Indiscriminate use of insecticides in onion cultivation with intensive agronomic practices affected both farm profitability and the farm. To combat the pests with eco-friendly practices, the scientists developed six components of an IPM package for onion. Adoption of integrated pest management (IPM) may provide an acceptable and affordable basis for pest control in vegetables. But alternative pest control strategies available at present are not very successful and popular among the farmers. In this context this study estimates cost of pest control and awareness and adoption of integrated pest and disease management practices in onion in Tamil Nadu.

II. Review of literature

The findings of Santha (1992) [9] revealed that a majority of farmers (48 per cent) was under high awareness category on cultural methods of IPM, while 22.5 and 20 per cent belonged to low and medium level categories respectively. In general, most of the IPM respondents belonged to high awareness category, while only one-fourth of the non-IPM farmers were in the high awareness category.

According to Sorensen (1993) [10] most farmers were using some IPM tactics, but were not incorporating a total systems approach in their farming operations. IPM producers were the one who used two or more IPM tactics. Based on this definition, anywhere between 15 and 25 percent of farmers today are practicing IPM.

According to Sujatha (1995) [11] adoption is the acceptance and application of some or all the recommendation practices by the respondents in crop husbandry.

Giriram and Sawarkar (1996) [12] defined awareness as the type of social component which increases the consciousness among the people and generate confidence in the individual to face the problems contemplatively.

Thanulingam (1996) [13] defined awareness as the ability of consumer to recall more or less currently the various aspects of consumer movement and consumer rights and the respondents’ clarity of understanding of the selected aspects.

Sri Ram (1997) [14] in his study meant adoption as following the eco-friendly agricultural practices in cotton cultivation as recommended by the extension agency.

According to Arul Murugan (2000) [15] awareness is the pre-requisite for how to do knowledge and adoption.

Priya (2006) [16] defined awareness as the things known to an individual presented as cognitive domain. It is a pre-requisite for adoption of innovation, as this would enable the farmers to completely understand the aspects behind IPM technology for vegetable crops and also its relative advantage. She also defined adoption as a decision to use the practices on continued basis.

III. Methodology

A. Sampling design and data sources

Sample size can be determined by using various methods. To determine the sample size, the purpose of the study, the population size, the level of precision, the level of confidence or risk and the degree of variability in the attributes being measured were considered [17]. The level of precision, sometimes called sampling error, is the range in which the true value of the population is estimated to fall. The confidence or risk level is based on the Central Limit Theorem which says that when a population is repeatedly sampled, the average value of the attribute obtained by those samples is equal to the true population value.

There are several approaches to determine sample size. These include using a census for small populations, repeating a sample size of similar studies, using published tables, and applying formulas to calculate the sample size.
Yamane [18] provides a simple formula to calculate sample sizes. The necessary sample size can be calculated for various combinations of levels of precision, confidence and variability by using following formula:

\[ n = \frac{N}{1 + N \cdot e^2} \]

- \( n \) – Sample size
- \( N \) – Population size
- \( e \) – Level of precision

The sample size was derived based on the confidence interval method. Sample size was fixed with 10% precision levels and a 95% confidence level with a 0.5 probability. The details of sample size for the targeted villages are presented in Table 1. Following the sample size, the farmers were selected randomly.

### Table 1. Sample size for the surveyed villages

<table>
<thead>
<tr>
<th>S. No</th>
<th>District</th>
<th>Village</th>
<th>IPM</th>
<th>Non-IPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perambalur</td>
<td>Irur</td>
<td>17</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>Perambalur</td>
<td>Chattiramanai</td>
<td>16</td>
<td>71</td>
</tr>
<tr>
<td>3</td>
<td>Trichy</td>
<td>Saengattupatti</td>
<td>20</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>53</td>
<td>211</td>
</tr>
</tbody>
</table>

### B. Awareness and adoption indices

Adoption is an outcome of a decision to accept a given innovation. Much scholarly interest on adoption falls in two categories: rate of adoption and intensity of adoption. It is usually necessary to distinguish between these two concepts as they often have different policy implications. Rate of adoption refers to the relative speed with which farmers adopt an innovation. On the other hand, intensity of adoption refers to the level of use of a given technology in any time period. The rate of adoption is usually measured by the length of time required for a certain percentage of members of a system to adopt an innovation. Extent of adoption on the other hand is measured from the number of technologies being adopted and the number of producers adopting them. The current study focuses on the extent of adoption and the factors affecting it. Several stages precede adoption. Awareness of a need is generally perceived as a first step in adoption process. Hence to know the extent of awareness and the adoption rate of onion IPM practices awareness index and adoption index were constructed.

An awareness index (AWI) and an adoption index (ADI) will give an overall picture about the awareness and adoption of IPM measures in the onion. These indices were constructed from the per cent of awareness and adoption of various recommended IPM measures \((i^{th}\) number of measures) as follows.

\[ AWI = \left( \sum_{i=1}^{n} AW_i \right) / n \]

where,
- AWI – Awareness Index
- \( AW_i \) - Per cent of awareness of \( i^{th} \) IPM measure, \( i = 1,2,\ldots,n \)
- \( n \) – Total number of IPM practices

\[ ADI = \left( \sum_{i=1}^{n} AD_i \right) / n \]

where,
- ADI – Adoption Index
- \( AD_i \) - Per cent of adoption of \( i^{th} \) IPM measure, \( i = 1,2,\ldots,n \)
- \( n \) – Total number of IPM practices
IV. Results and Discussion

Awareness and Adoption Levels of IPM Practices in Onion

Adoption is an outcome of a decision to accept a given innovation. Awareness of a need is generally perceived as a first step in the adoption process. As discussed earlier, six IPM packages were recommended by the scientists for onion. Awareness and adoption level of each package was calculated and it is presented in the Table 2. Based on Table 2, an awareness index (AWI) and an adoption index (ADI) were constructed and it is presented in the Table 3.

Table 2. Awareness and adoption levels of IPM practices in onion

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Awareness level</th>
<th>Adoption level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichoderma viride</td>
<td>65 (24.62)</td>
<td>46 (17.42)</td>
</tr>
<tr>
<td>Pseudomonas fluorescens</td>
<td>59 (22.35)</td>
<td>41 (15.53)</td>
</tr>
<tr>
<td>Yellow sticky trap</td>
<td>8 (3.03)</td>
<td>5 (1.89)</td>
</tr>
<tr>
<td>VAM</td>
<td>5 (1.89)</td>
<td>5 (1.89)</td>
</tr>
<tr>
<td>Neem products</td>
<td>65 (24.62)</td>
<td>38 (14.39)</td>
</tr>
<tr>
<td>Pheromone trap</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(Figures in the parentheses indicate percentages to the total)

The results provided in Table 2 revealed that overall though awareness was up to 25 percent, the adoption was only up to 18 percent. Commodity wise although nearly 25 percent were aware of the important IPM practice Trichoderma viride, only 17.42 percent adopted it. In the same way, 22.35 percent were aware of Pseudomonas fluorescens, but only 15.53 percent adopted it. Respectively, 3.03 percent and 1.89 percent of the sample onion cultivators were aware of yellow sticky trap and Vesicular Arbuscular Mycorrhiza (VAM) but only 1.89 percent adopted those practices. In the same way 24.62 percent were aware of neem products and 14.39 percent adopted it. None of them were aware of pheromone traps and hence they were not adopted.

The indices for awareness and adoption are given in Table 3.

Table 3. Awareness and adoption Index for IPM in onion

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness index (AWI)</td>
<td>12.12</td>
</tr>
<tr>
<td>Adoption Index (ADI)</td>
<td>8.52</td>
</tr>
</tbody>
</table>

The results indicated that though the awareness index was 12.12, the adoption index was only 8.52, which shows only that 75 percent of the technology generated was adopted in the field.

V. References


