Innovative Front Line Demonstrations in Tribal Areas to Enhance Brinjal Income through Integrated Pest and Disease Management East Godavari District-A.P

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Abstract: The Brinjal cover largest area and play an important role in total vegetable production in India. Brinjal crop suffers more from fruit and shoot borer insect pest and disease attack. Due to lack of awareness of tribal farmers, KVK scientists promoted the integrated pest management practices in tribal areas for the suppression of pests and diseases. The integrated pest management strategy involving many components was demonstrated through innovative large scale contagious technology demonstration in 50 acres brinjal (Local variety) crop area during the year 2014-2015 Kharif season in rain fed track of East Godavari District in Andhra Pradesh, India. The various production and protection parameters indicated that adoption of IPDM strategies decrease the cost of production without affecting the yield. The IPDM demonstration, insecticides sprays quantity reduction in Brinjal was 40 litres per acre respectively as compared to the local check. Adoption of IPDM technology increased the net income over the local check in Brinjal local varieties Rs. 103000/ac. In spite of increase in yield of brinjal, technological gap, extension gap and technology index existed. The improved technology gave higher gross return, net return with higher benefit cost ratio as farmer’s practices.

Index Terms: Brinjal local varities, IPM, fruit and shoot borers, Bacterial wilt.

I. INTRODUCTION

Eggplant (Solanum melongena L.), also called aubergine or brinjal, is one of the top ten vegetables in the world. It is grown on more than 2 million ha with a production of nearly 33 mt. China is the world’s top eggplant grower, accounting for more than half of world acreage and India is second, with about one quarter of the world total; Indonesia, Egypt, Turkey, Iraq and the Philippines are the other major eggplant producing countries. Asia accounts for about 94 percent of the world eggplant area, with about 92 percent of world output [8]. India and Indochina are considered the centers of origin for egg plant [34]. Eggplant is well adapted to high rainfall and high temperatures, and is among the few vegetables capable of high yields in hot-wet environments [12]. Eggplant contains nutrients such as dietary fiber, folate, ascorbic acid, vitamin K, niacin, vitamin B6, pantothenic acid, potassium, iron, magnesium, manganese, phosphorus, and copper [32]; The nutrients that it contributes to the diets of the poor are especially important during times when other vegetables are in short supply.

Now most of the solanaceous vegetables are available throughout the year. However, there is a risk of severe damage by insect pests and diseases. Particularly, the insects that damage these crops range in their ability to reduce yields at different growth stages. Moreover, insects that transmit disease agents, such as whitefly or thrips vectored plant viruses, can also have similar devastating effects on yield. Vulnerability of the solanaceous brinjal vegetable to insect pests and diseases continues to be one of the major factors responsible for the lower productivity with wider fluctuation [27]. Brinjal local variety which is prone to L. orbonalis is considered the main constraint as it damages the crop throughout the year. This pest is reported from all brinjal growing areas of the world including Germany, Burma, Sri Lanka and India. It is known to damage shoot and fruit of brinjal in all stages of its growth. The yield loss due to the pest is to the extent of 70-92 per cent [7]-[4]-[15]. The infested fruits become unfit for consumption due to loss of quality and hence, lose their market value. It is also reported that there will be reduction in vitamin C content to an extent of 68 per cent in the infested fruits [14].

Growers rely heavily on chemical pesticides to protect their eggplant crop. For instance, farmers in certain areas of Philippines spray chemical insecticides up to 56 times during a cropping season; The total quantity of pesticide used per hectare of eggplant was about 41 litres of different brands belonging to the four major
pesticide groups [9]-[25]. In Bangladesh, some farmers spray about 180 times during a cropping season [29]. Pesticide misuse has adverse effects on the environment and human health and also increases the cost of production. The share of the cost of pesticide to total material input cost was 55% for eggplant compared with cabbage (49%) and tomato (31%) in the Philippines [25], and accounted for 40–50 percent in Bangladesh [29]. Many farmers refrain from growing eggplant due to the cost of pesticides [9].

Brinjal being a vegetable crop, use of chemical insecticides will leave considerable toxic residues on the fruits. Besides this, sole dependence on insecticides for the control of this pest has led to insecticidal resistance by the pest [23]-[13]. Hence, use of organic amendments, plant products and microbial origin insecticides can be the novel approaches to manage the pest. Considering the changing scenario in demand of vegetables, there is further need for increasing productivity and profitability along with the quality vegetables production in the country. There is a potential to increase production of solanaceous vegetables by using best production practices and right combination of input at right time [20] to bridge the yield gap between demonstration trials and farmer’s field. Several technologies and management options are developed for protecting the crops, that can significantly reduce the losses due to insect pests, but adoption of these technologies by the farmers has been far less than anticipated.

Though IPDM developed long back, the technological knowledge and adoption rate was low in the minds of brinjal farmers. The improved technology package was found beneficially attractive, yet adoption levels for several components were low, hence emphasizing the need for better dissemination innovative large scale 50 acres IPDM front line demonstration was planned and implemented successively during the year 2014-2015 (Kharif season) to diffuse and influence the practices of IPDM technology on yield, cost of plant protection, quantity of pesticides consumption and frequency of pesticides sprays. Realizing the importance of extending these technologies for management insect pests in brinjal vegetable crop at farmers’ level, frontline demonstrations (FLDs) were conducted to show the productivity potential and profitability of need based plant protection.

II. MATERIALS AND METHODOLOGY

Large scale integrated pest and disease management demonstrations were conducted with brinjal local varieties in a contagious area of 50 acres during the year 2014-15 in rain fed tracks of East Godavari District of Andhra Pradesh state during Kharif season. The 50 acres in the year of 2014-2015 in fifty different locations of the district involving 50 farmers irrespective of their farm size and brinjal crop area. The selection of taluk, village and farmers were made purposively looking the criteria of continuity of brinjal crop in that area, brinjal crop pest and disease population and lack of IPDM package of practices.

Materials Distributed to each farmer:

1. CuSo₄ – 5Kg
2. Lime – 5Kg
3. Pheromone traps – 16pc
4. Pheromone lure – 24
5. Proclaim – 80g
6. Spinosad – 80ml
7. Cabriotop – 240g
8. Natio – 120g and Neem oil – 1lt

Before conducting of demonstrations the actual existing field problems of brinjal growing farmers and technological gaps in brinjal production were identified with care through extension methods like survey, group discussion, secondary data and gram Sabha. During the conduct of these resource inventory techniques farmers were facilitated to express the constraints in the production of brinjal crop over the years. Due care was taken to listen and consider the field experiences of progressive brinjal growers, medium to big land holders and categories of tribal farmers and gender. The components of IPDM demonstration in brinjal were summer ploughing, sowing of insecticides treated seeds, soil drenching with copper oxy chloride (blitox), monitoring of pest load through pheromone traps, insecticidal sprays with emamectin benzoate (proclaim), spinosad at vegetative stage; need based application of neem and need based sprays of chemical pesticides, excluding the release of trichogramma egg card and HNPV. With all these farmer’s practices collected the data on yield gaps between potential yield and demonstration yield, extension gap, technology index, quantity of insecticides used and reduction of plant protection were the parameters observed to analyze the impact of IPDM in enhancing the productivity in turn net income from brinjal cultivation. The insect pest population level and stage of crop was
considered to impose the IPDM components. Traditional calendar based pest management practices were considered as local check for comparative study. Technological gap, extension gap and the technological index were calculated using the following standard formula [28].

Technology gap = Potential yield – Demonstration yield;
Extension gap = Demonstration yield – Farmers / Local check yield;
Technology index = \([\text{(Potential yield – Demonstration yield) / Potential yield}] \times 100\).

III. RESULTS AND DISCUSSION
The data presented in the table 1 revealed that the yield difference between potential, demonstration and local check attributed for the fact that the brinjal was grown in the rain fed situations during Kharif season. The study revealed that there was much difference in the yield of brinjal both in the demonstration and local check. The per cent increase in the yield of brinjal was 50. These results indicate that the IPDM technology had an impact on brinjal yields. The technology gap in the yield of brinjal was 2t/ac (Table1). The probable reason for this gap due to the lack of awareness in tribal farmers. Generally as seen in the demonstration field’s brinjal was cultivated in medium to deep red soils. The extension gap was 8t/ac in brinjal local varieties. The data shows that there was much extension gap in the yield levels; however some more efforts are yet to be intervened to convince the advantages and effectiveness of IPDM technologies. The knowledge up gradation on eco friendly farmer friendly and cost effective technologies, time of proper use of IPDM inputs and accessibility of IPM inputs at times of need may definitely create positive impact on the enhanced yields of brinjal and also influence in the reduction of brinjal pest and disease load. Spinosad and emamectin benzoate were effective in suppressing the fruit infestation by brinjal shoot and fruit borer [2]. Better control of lepideroptan pests on cotton with spinosad [5]. The efficacy of spinosad against Heliothis species is well documented [19]-[3]-[18]-[21]-[33]-[11]. It has also been found very effective against diamondback moth [35]-[30]. The IPDM technologies demonstrated eventually lead the farmers to discontinue the old practices with adoption of demonstrated practices. The technology index showed the feasibility of the evolved technology at farmer’s fields. Female pheromone attracts the male eggplant shoot and fruit borer. The pheromone lure could be used in catching male adults to control this pest population in eggplant fields [22]. The lower the value of technology index the more shall be the feasibility of the technology. The technology index of brinjal was 16.6 per cent. Considering these data it seems that the technology is 16.6 per cent feasible. However, in view of the ecological safety and net economic benefits (Table 2) the technology is much feasible as IPDM technology includes ecologically safer pest management practices.

Although, the reports on efficacy of this pesticide are not found on brinjal jassids, most related compound avermectin provided moderate control of jassids on brinjal in West Bengal [10]. Spinosad was characterized in 1988 and consists of a mixture of related spinosyn toxins, principally spinosyn A and D. It has very good contact and stomach activity. It shows no effects on the predatory insects such as lady bird beetles, lacewings, big eyed bugs and shows reduced activity against parasitic wasps and flies. Because of low applicator’s risks, it was recommended as an IPM tool [24].

Different parts of neem are known to contain over 40 bitter principles belonging to the terpenoid, triterpenoid, limonoid and flavanoid group of natural products [31] the most well known are the azadirachtins. The Central Insecticides Board of India has approved the registration of 300 ppm oil based and 1500 ppm kernel based neem formulations [1]. Neem oil formulations have been tried as seed dressing, seed coating, seedling bare root dip treatment and soil drenching [6]-[16]-[17]. Indian farmers without the knowledge of the chemical constituents have been using neem products as a traditional method of pest control for centuries. The increasing interest in neem in recent years has resulted in the development of cheap, safer and eco-friendly nematicides and pesticides. Neem seed constitutes the basic raw materials for neem products. The additional income due to increased yield and saving on plant protection chemical in brinjal was Rupees 100000/- and Rupees 3000/- per acre respectively (Table 2). These data showed that the adoption of IPDM technology increased the net income over the local check in brinjal (Rs.103000 per acre). The data showed that per cent reduction in cost of Plant Protection was 42.85 (Table 3). The data on impact of lucid lure pheromone traps on the level of sucking pests incidence (table 4) in brinjal showed reduction in number, hence it can be concluded that physical control reduces chemical load and also the data on number of sprays (Table 5) in brinjal showed reduction in number, hence it can be concluded that IPDM technology reduces usage of plant protection chemicals on brinjal production system.
IV. CONCLUSION

Tribal farmers around the world both large and small holders benefit from this technology through increased productivity, convenience and time savings. The vast majority of farmers using brinjal globally are small holder farmers. The economic, environmental, and social benefits derived from adoption of this important tool have very positive implications for the farmers, their surrounding communities and the future of agriculture [26]. In brinjal production system, IPDM technology was found as imperative for common pest problems. The adoption of IPDM technology increased the net income. There is need to adopt multipronged strategy that involves enhancing income of brinjal tribal farmers through effective management of insect pest with the adoption of IPDM technology. Hence, the technology may be popularized to mitigate the extension gap.

REFERENCES


AUTHOR BIOGRAPHY
Subject Matter Specialist (Plant Pathology), C/O Krishi Vigyan Kendra, Pandirimamidi. E-mail: vgrao2007@gmail.com. Awarded B.Sc., M.Sc., degrees from Acharya N.G. Ranga Agricultural University, Andhra Pradesh. He has served in the cadre of assistant professor at Krishi Vigyan Kendra as Subject Matter Specialist (Plant Pathology) to cater the actual problems and difficulties faced by farmers in East
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**APPENDIX**

Table 1. Productivity, Yield Gap and Technology Index of IPDM Demonstration Type of brinjal: Local variety

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Average Yield (qt/ac)</td>
<td>12t/acre</td>
</tr>
<tr>
<td>Average Yield (qt/ac)</td>
<td>10t/acre</td>
</tr>
<tr>
<td>Average Yield (qt/ac)</td>
<td>5t/acre</td>
</tr>
<tr>
<td>Per Cent Increase in Yield</td>
<td>50%</td>
</tr>
<tr>
<td>Technology Gap</td>
<td>2t/acre</td>
</tr>
<tr>
<td>Extension Gap</td>
<td>8t/acre</td>
</tr>
<tr>
<td>Technology Index</td>
<td>16.6%</td>
</tr>
</tbody>
</table>

Table 2. Economics of IPM Demonstration

<table>
<thead>
<tr>
<th>Increased Yield (Extn Gap Over Local Check) (t/ac)</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Price of Brinjal (Rs./t)</td>
<td>20000</td>
</tr>
<tr>
<td>Additional Income Due to Increased Yield (Rs./ac)</td>
<td>100000</td>
</tr>
<tr>
<td>Amount saved in plant protection chemical over local check (Rs./ac)</td>
<td>3000</td>
</tr>
<tr>
<td>Net Income Gained (Rs./ac)</td>
<td>103000</td>
</tr>
</tbody>
</table>

Table 3. Cost of Plant Protection in Cotton IPM Demonstration

<table>
<thead>
<tr>
<th>Cost of plant protection under Demonstration (Rs./ac)</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of plant protection under Local Check (Rs./ac)</td>
<td>7000</td>
</tr>
<tr>
<td>Per Cent reduction in cost of Plant Protection</td>
<td>42.85</td>
</tr>
<tr>
<td>Economic Extension Gap</td>
<td>-3000</td>
</tr>
</tbody>
</table>

Negative digits of economic extension gap can be read as saving on plant protection chemicals

Table 4. Impact of lucid lure sex pheromone traps on the level of sucking pests incidence

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the month</th>
<th>Effect of sex pheromone traps on the mortality of insects/1 trap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Period</td>
</tr>
<tr>
<td>1</td>
<td>July</td>
<td>1st</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3rd</td>
</tr>
<tr>
<td>2</td>
<td>August</td>
<td>1st</td>
</tr>
</tbody>
</table>
Table 5. Number of Sprays to Cotton IPM Demonstration

<table>
<thead>
<tr>
<th>Month</th>
<th>1st</th>
<th>3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>October</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>November</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>December</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Number of sprays under Demonstration: 12
Number of sprays under Local check: 20
Per Cent reduction in sprays: 40
Extension Gap: -8

Negative digits of extension gap can be read as reduction in number of plant protection chemical sprayed in one acre area.