

Assessment and Impact of Bio-Management of Diamondback Moth in Cauliflower

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ABSTRACT

Diamondback moth [Plutella xylostella (L.)] is the most serious and widely distributed pest of cauliflower (Brassica oleracea var. botrytis) in India, attacking the crop from the nursery level onwards causing up to 52 per cent losses in marketable yield. To manage the menace farmers were using conventional as well as novel pesticides including Flubendiamid, 20 per cent WG, Spinosad 2.5 per cent SC and Fipronil 0.30 per cent GR. The problems of insecticide resistance as well as the environmental concerns and consumer health hazards associated with insecticide residues in plant material have focused attention on alternative methods for the management of diamondback moth (DBM) in cauliflower. With the objectives to minimize the use of chemical pesticides and establish the use of eco-friendly bio-control agents, an assessment and front line demonstrations were organized during 2009 and 2010 to evaluate the feasibility and economic viability of recommended bio-control agent i.e. Beauveria bassiana for containing DBM in cauliflower under real farm condition. On the basis of result obtained from assessment of recommended technology, frontline demonstrations were organized to disseminate the recommended practice [foliar spray of Beauveria bassiana (1x10¹⁰ conidia/ml)] a myco-insecticide (@600 ml/ha) amongst the farmers. The recommended technology was found to offer an alternative to insecticides and was feasible, economically viable, environmentally safe and effective for management of DBM in cauliflower.

Key words: Assessment; Impact; Cauliflower; Diamondback moth;

India is the largest producer of cauliflower in the world, which occupies 4.4 per cent area and 5 per cent of total vegetable production in the country. Madhya Pradesh accounts for 4001 ha and 778001 MT sharing 11.60 per cent and 11.92 per cent of total area and production respectively, during 2008-09 at national level (Anonymous, 2010). With the development of tropical type of cauliflower in addition to temperate one, it has now become possible to grow this crop almost round the year, particularly central part of India. Cauliflower is an input intensive crop, which is prone to many insect pests, especially to diamondback moth [*Plutella xylostella* (L.)]. This is one of the most serious and widely distributed pests of the cruciferous crops in many countries including India (Bonnemaison, 1965 and Chelliah and Srinivasan, 1986). It infests the crop from the nursery level onwards causing up to 52 per cent losses in marketable yield (Krishnakumar et al., 1986). The management of this pest in India itself involves an expenditure of US\$ 168 million per annum

(Sandur, 2004). This pest has become a consistent threat to cauliflower growers of Malwa plateau. To keep this menace under control, farmers have been using flubendiamid, 20 per cent WG, Spinosad 2.5 per cent SC and Fipronil 0.30 per cent GR, which is leading to pest resistance against these chemicals (Keinmeesuke et al., 1985), in addition the issues of environmental and health hazards. With the objectives to minimize the use of pesticide and establish the use of bio-control agents for management of DBM in cauliflower, 'on farm trials' and 'front line demonstrations' were organized during 2009 and 2010, respectively. Yield and economic feasibility in terms of net returns and cost benefit ratio of practicing bio-control of DBM in comparison to farmers practice were analyzed.

METHODOLOGY

Assessment and impact of bio-management of DBM in cauliflower (var- Rajkumar) were carried out through 'on farm trials' and 'front line demonstrations'

at village Chirakhan of Indore district during 2009-10 and 2010-2011 by Krishi Vigyan Kendra, Kasturbagam. For 'on farm trials', six innovative and receptive farmers were selected for conducting the trials. Area under each trial was 0.25 ha with the four considerations, namely farmer's perspective, farmer's participation, farmer's management status and suitability of site as suggested by Singh (1999). Foliar spray of *Beauveria bassiana* (1 x 10¹⁰ conidia/ml) a myco-insecticide @ 600 ml/ha after 30 days and 55 days after transplanting were used as bio-pesticide for management of DBM as recommended by International Institute of Tropical Agriculture (James et al., 2007 and Ghos et al., 2007). Ten pheromone traps /ha of Lure of *Plutella xylostella* (DBM) were also installed after 15 days of transplanting for monitoring the presence of DBM in the field. The existing farmer practice i.e. regular spray Fipronil 0.30 per cent GR and flubendiamide 39.35 per cent SC were treated as control for comparison. Similarly 07 farmers of the same village were selected for front line demonstrations (each on 0.40 ha land) during 2010-2011. A fortnight ago of conducting demonstrations, training to the farmers was imparted with respect to envisaged technological intervention. Other steps like selection of experimental site and farmers, layout of demonstration, farmers' participation etc. were followed as suggested by Choudhary (1999). Visits of the farmers and extension functionaries at demonstration plots were organized to get convinced and for further dissemination of the imparted technology. Plot-wise yield data was recorded from recommended practice and farmer's plots. Information of cost of cultivation was also recorded for economic evaluation in terms of net profit earned and the benefit cost ratio.

RESULTS AND DISCUSSION

The mean yield performance and economics of six 'on farm trials' due to recommended technology and farmers practice were assessed (Table 1). Of the two treatments, recommended practice i.e. foliar spray of *Beauveria bassiana* (1 x 10¹⁰ conidia/ml) @ 600 ml/ha

were found alternate, effective and biological means for management of DBM in cauliflower over farmers' practice (regular spray of chemical insecticides i.e. Fipronil 0.30 per cent GR, spinosad 2.5 per cent SC and flubendiamide 39.35 per cent SC). The yield performance of recommended practice was 230 q/ha which is 3.62 per cent higher to farmer practice (221 q/ha). The count of DBM larvae per square meter was found 5.5 in case of recommended practice while it was 6.1 in farmers practice.

Economics evaluation in terms of gross expenditure, gross return, net return and BC ratio (Table 1) clearly revealed that the net returns from the recommended practice were substantially higher than farmers practice. Net returns from recommended practice were observed to be Rs 137208/ha in comparison Rs 127578 to farmers practice, with an additional income of Rs 9630/ha. These benefits can be attributed to the technological intervention provided in on farm trial. The cost benefit ratio of recommended practice (5.20) was also higher than farmers practice (4.45). Thus, favorable cost-benefit ratio and higher net returns proved the economic viability of the assessed technology and convinced the farmers on the utility of technology provided at real farming situation. Similar findings were reported by Mishra et al., (2007) in onion. Outcome of the 'on farm trials' organized clearly brings out that the dissemination of assessed technology is feasible, economically viable and environmentally safe for containing DBM in cauliflower. Resistance of most of the conventional insecticides has developed (Sun et al., 1986) due to continuous cultivation and short life cycle of 14 days and more than 25 generations of DBM per year. This high level selection pressure and the high fecundity of DBM are key factors which may have contributed to this species developing resistance to a wide range of insecticides in the field (Wright, 2004) including novel insecticides such as Spinosad and Indoxacarb (Zhao et al., 2006) as well as some strain of bacterial insecticide *Bacillus thuringiensis* (Shelton et al., 2007). The problems of insecticide resistance

Table 1. Assessment of biological control of Diamondback moth in cauliflower (2009-10)

Treatment	Yield (q/ha)	Yield % increase over Farmer's practice	Count of Larvae/m ²	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
Farmers Practice	221	-	6.1	36763	164341	127578	4.45
Recommended practice*	230	3.62	5.5	32963	170166	137203	5.20

* Foliar spray of *Beauveria bassiana* (1 x 10¹⁰ conidia/ml) @ 600 ml/ha

Table 02. Impact of frontline demonstrations on yield and economics of cauliflower (2010-11)

Treatment	Yield (q/ha)	Yield % increase over Farmer's practice	Count of Larvae/m ²	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
Farmers Practice	207	-	5.42	25621	124114	98493	4.87
Bio-control	219	5.79	5.1	25386	131914	106528	5.29

* Foliar spray of *Beauveria bassiana* (1 x 10¹⁰ conidia/ml) @ 600 ml/ha

as well the environmental and consumer health hazards associated with insecticide residues in plant material have focused attention on alternative methods for the management of DBM, hence the assessment of bio-control agents like *Beauveria bassiana* for incorporation into integrated pest management programme against this insect is a dire need. The assessment could convince on account of its obvious advantages and effective management of DBM in cauliflower. These innovative practices showed solving the farmers problem, decision-making and ability to modify their farming practices.

On the basis of outcome from assessment of recommended technology 07 frontline demonstrations were organized and their yield performance and economics due to recommended technology and farmers practice were analyzed and presented (Table 02).

The yield performance of recommended practice was 219 q/ha which is 5.79 per cent higher to farmer practice (207 q/ha). The count of DBM larvae per square meter was found 5.42 in case of recommended practice while it was 5.1 in farmers practice. Economics evaluation in terms of gross expenditure, gross returns, net returns and BC ratio (Table 02) clearly revealed that the net returns from the recommended practice were substantially higher than farmers practice. Net

returns from recommended practice were observed to be Rs 106528/ha in comparison Rs 98493 to farmers practice, with an additional income of Rs 8035/ha, which can be attributed to the technological intervention provided in frontline demonstration. The cost benefit ratio of recommended practice (5.29) was also higher than farmers practice (4.29). Thus, favorable cost benefit ratio and higher net returns proved the economic viability of the recommended technology and convinced the farmers on the utility of technology provided at real farming situation.

CONCLUSION

The problems of insecticide resistance as well the environmental and consumer health hazards associated with insecticide residues in plant material have focused attention on alternative methods for the management of Diamondback moth. On the basis of result obtain from the assessment of on farm trials and analysis of result obtain from front line demonstration, it is obvious that recommended practice [foliar spray of *Beauveria bassiana* (1 x 10¹⁰ conidia/ml) @ 600 ml/ha] was found feasible, economically viable, environmentally safe and effective technology for management DBM in cauliflower.

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