

# Pest Management Technologies in Rainy Season Cauliflower

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Cauliflower is an important cole crop vegetable grown extensively in almost every part of the country round the year. This crop has great nutritional value and reported to have vitamin A and C, proteins, carbohydrates and minerals such as potassium, sodium, iron, phosphorous, calcium, and magnesium. Insect pests cause enormous yield and economic losses in *Brassica* crop production every year, and are a threat to global agriculture. Sometimes the yield loss by insects reaches as high as 60-70% and it is reported that Indian agriculture is currently suffering an annual loss of about ₹ 86.39 million due to insect pests. Major insect pests of cauliflower include aphids (*Myzus persicae* [Sulzer], *Lipaphis erysimi* [Kaltenbach]), painted bug (*Bagrada hilaris* [Burmeister]) cabbage head borer (*Hellula undalis* F.), diamondback moth (*Plutella xylostella* [L.]), cabbage webworm (*Crociodolomia binotalis* Zeller), tobacco caterpillar (*Spodoptera litura* [F.]) and mustard saw fly (*Athalia lugens proxima* [Klug]). Damping off (*Pythium aphanidermatum*), *Rhizoctonia* root rot, *Alternaria* leaf spot/blight (*Alternaria brassicicola*), black rot (*Xanthomonas campestris*), bacterial rot (*Erwinia* sp.) etc are major diseases of cauliflower crop. Several species of Root-knot nematode *i.e.* *Meloidogyne incognita*, *Rotylenchulus reniformis* and *Hoplolaimus indicus* were found infecting cauliflower in Varanasi region of India. It is reported that these pests cause damage to an extent of 80-100 % per cent in nurseries under favourable conditions and 10-25 per cent in field crops. Keeping all these facts in view, a very feasible, cost effective and environment friendly IPM strategies were devised validated in rainy season cauliflower crop which is prone to insect pests and disease attack as compare to winter season cauliflower.

A baseline survey was conducted in two villages *i.e.* Khanpur and Uncha Majra of district Gurugram (Haryana). Pests problem is a threat to rainy season cauliflower not to winter season. Total area under cauliflower is more than 2000 ha. Important pests infesting rainy season cauliflower in this area are following; Insect pests: tobacco caterpillar, *Spodoptera litura* is main defoliator insect and in some area Diamond back moth, *Plutella xylostella*. Diseases; Damping off, root rot, black rot and *Alternaria* leaf blight were major diseases. Very minor infestation by root knot nematode was observed. Farmer's knowledge about IPM, pests and natural enemies identification is almost nil. Blanket pesticide application whether relevant or not, is scheduled activity. In rainy season

cauliflower farmers normally spray 9-10 rounds of pesticides almost once in a week injudiciously at the behest of pesticide dealers and spend more than Rs. 25,000/- per ha. Hence development, validation and implementation of user and eco-friendly IPM strategies in the rainy season cauliflower was utmost necessity of the area. Therefore, a suitable pest management technology that can be adopted by the farmers with greater ease and is economically viable and can be implemented in a compatible manner in farmer's participatory mode was validated and disseminated in rainy season cauliflower.

## IPM Strategy

IPM components consisted of raised bed nursery about 15 cm above the ground level for good drainage and to avoid the diseases like damping off, root rot etc; uses of well rotten farm yard manure (FYM) @ 3 kg/m<sup>2</sup> treated with *Trichoderma viride* @ 150g and neem cake @ 50g/m<sup>2</sup> to avoid the soil borne diseases; seed treatment with *Trichoderma viride* 1.0% WP @ 4 g/kg and need based use of captan 75% WP @ 0.25% against soil borne diseases in nursery while in main field uses of well rotten farm yard manure (FYM) @ 20-25 t/ha treated with *Trichoderma viride* 1.0% WP @ 2.5 kg/ha; seedlings dip in *Trichoderma viride* 1.0% WP @ 10 g/litre of water for 30 minutes to avoid the soil borne diseases; managing the weeds through proper inter culture operations; installation of pheromone traps against *Spodoptera litura*; collection and destruction of eggs masses and larvae of *Spodoptera litura* and uses of need based application of label claim insecticides like Cyantraniliprole 10.26% OD @ 60 g a.i./ha and or Fenvalerate 20% EC @ 60-75 g a.i./ha against insect pests and use of fungicides like mancozeb 75% WP @ 3g per litre of water and or combination product *i.e.* Azoxystrobin 4.8% w/w + Chlorothalonil 40% w/w SC @ (0.144+1.2) kg a.i./ha (formulation dose 3 litre/ha) to manage the various diseases. Pesticide residue in cauliflower produce was also analyzed under IPM, FP and control.

## Implementation of IPM

Location specific IPM technologies indicated as above were validated in rainy season cauliflower continuously for three years at the village Uncha Majra, district Gurugram of Haryana state during



2022-23 to 2024-25 in 10 acre area along with untreated control and disseminated during 2025-26 in the villages *i.e.* Uncha Majra, Narhera, Bhora Kalan, Bhora Khurd, Nurpur, Bas Padamka and Panch gaon of district Gurugram, Haryana (Hub of rainy season cauliflower production).

### Impact on pest population

Data presented in table 1 indicated that a significantly low per cent of damping off and *Rhizoctonia* root rot was recorded in IPM over the farmer's practice (FP) and untreated control during 2022-23 to 2024-25. It was mainly due to raised bed nursery and application of *Trichoderma viridae* in IPM field. Black rot severity (PDI) caused by *Xanthomonas campestris* pv. *campestris* was significantly low in IPM over the FP and untreated control. It was first reported during last week of September and increased to significantly higher level during last week of October. Area Under Disease Progress Curve (AUDPC) was highest in control followed by FP and IPM. Significantly low severity of *Alternaria* blight was recorded in IPM as compare to FP and untreated control during all the three years of validation. It did not pose any serious threat. ADPUC was least in IPM followed by FP and untreated control. *Spodoptera litura* larvae incidence was noticed during mid August and reached on peak during mid September. Significantly low population of larvae per plant was recorded in IPM over the FP and untreated control. Maximum number of *S. litura* adult per trap were observed during 38<sup>th</sup> Std. week while it was declined to lowest level during 48<sup>th</sup> Std. week. Significantly higher spider population per m<sup>2</sup> was recorded in IPM and control over the FP. No plant parasitic nematodes were recorded except few saprophytic nematodes during entire period of study.



**Table 1: Status of pests and natural enemies under different practices**

Practices	Damping off (%)	<i>Rhizoctonia</i> root rot (%)	Black rot PDI (AUDPC)	<i>Alternaria</i> leaf blight PDI (AUDPC)	No. of <i>S. litura</i> larvae/plant	No. of spiders/M <sup>2</sup>
<b>2022-23</b>						
IPM	4.3	3.6	13.8 (992)	9.3 (454)	0.06	2.76
FP	10.3	6.04	18.4 (1253)	14.8 (681)	1.28	0.64
Control	22.1	8.0	22.7 (1664)	16.0 (788)	3.12	3.04
CD @ 5%	1.90	1.31	1.77	1.10	0.05	0.13
SE(m)	0.81	0.40	0.53	0.33	0.01	0.04
<b>2023-24</b>						
IPM	3.6	4.0	18.6 (743)	10.6 (199)	0.1	3.2
FP	15.6	7.6	30.1 (1114)	15.2 (287)	2.3	0.5
Control	31.6	12.0	45.2 (1592)	25.2 (449)	4.3	3.5
CD @ 5%	1.14	1.95	2.40	1.40	0.13	0.12
SE(m)	0.31	0.59	0.73	0.42	0.04	0.04
<b>2024-25</b>						
IPM	5.1	3.2	25.6 (1071)	12.4 (251)	0.2	3.5
FP	20.3	8.4	40.8 (1412)	15.6 (346)	3.2	0.8
Control	34.4	16.0	51.6 (2121)	20.8 (434)	5.4	4.5
CD @ 5%	1.62	1.15	1.57	2.06	0.14	0.15
SE(m)	0.49	0.35	0.47	0.62	0.04	0.05

Table 2: Impact of IPM on per cent reduction of pests over the untreated control

Practices	% reduction of pests under IPM and FP over the control					% increase of spiders over FP
	Damping off (%)	Rhizoctonia root rot (%)	Black rot PDI (AUDPC)	<i>Alternaria</i> leaf blight PDI (AUDPC)	No. of <i>S. litura</i> larvae/plant	
2022-23						
IPM	80.5	55.0	40.0	42.0	98.0	431.0
FP	53.4	20.0	20.0	7.5	59.0	-
Control	-	-	-	-	-	475
2023-24						
IPM	88.6	66.7	59.0	58.0	98.0	640
FP	50.6	36.7	50.0	40.0	47.0	-
Control	-	-	-	-	-	700
2024-25						
IPM	85.0	86.0	50.0	40.0	96.0	337.5
FP	41.0	47.5	21.0	25.0	41.0	-
Control	-	-	-	-	-	462.5

It is revealed from table 2 that significantly higher per cent reduction (80.5, 88.6, 85.0); (55.0, 66.7, 86.0); (40.0, 59, 50.0) and (42.0, 58.0, 40.0) in damping off, *Rhizoctonia* root rot, black rot and *Alternaria* leaf blight diseases respectively was recorded under IPM over the untreated control during 2022-23, 2023-24 and 2024-25. Similarly, significantly higher per cent reduction 98.0, 98.0 and 96.0 in *S. litura* population per plant was recorded under IPM over the untreated control during 2022-23, 2023-24 and 2024-25 respectively.



## Economic impact of IPM

Significantly higher yield (q/ha) was recorded in IPM (225.55, 230.60, 210.6) over the FP (184.60, 195.50, 185.2) and control plots (130.5, 125.2, 102.5) during 2022-23, 2023-24 and 2024-25, respectively. Total expenditure on cauliflower production was quite low in IPM over the FP. Benefit: cost ratio was highest (5.4, 4.4, 4.7) in IPM over the FP (3.8, 3.1, 3.2) and control (2.6, 2.2, 2.3) during 2022-23, 2023-24 and 2024-25 respectively (Table 3).

Increase in spider population in IPM was three to six times compared to FP, which was due to the reduction in pesticides application. The reduction of 70 to 75 per cent in pesticide spray was recorded in IPM over the FP during 2022-24. No pesticide residue was recorded in cauliflower produce under IPM and control while residue of pesticides i.e. Azoxystrobin, Difenconazole, Fipronil, Thiamethoxam, Fenvalerate was recorded above permissible level under farmers practice.

Table 3: Yield and economic analysis of different practices

Practices	Yield (q/ha)	% increase in yield over the control	Total cost of production (Rs.)	Total return (Rs.)	Benefit-cost ratio	% reduction in pesticide spray over FP
2022-23						
IPM	225.55	73.0	1,08,530	5,86,430	5.4	70
FP	184.60	41.0	1,23,180	4,61,500	3.8	-
Control	130.50	-	1,00,200	2,61,000	2.6	-
CD @ 5% SE(m)	8.22 2.48	-	-	-	-	-
2023-24						
IPM	230.60	84.0	1,05,240	4,61,200	4.4	75
FP	195.50	56.0	1,20,320	3,71,450	3.1	-
Control	125.20	-	85,510	1,87,800	2.2	-
CD @ 5% SE(m)	10.85 3.26	-	-	-	-	-
2024-25						
IPM	210.6	105.0	98,500	5,86,430	4.7	70
FP	185.2	81.0	1,22,000	4,61,500	3.2	-
Control	102.5	-	80,400	2,61,000	2.3	-
CD @ 5% SE(m)	8.51 2.57	-	-	-	-	-

## Knowledge up gradation and development of linkages

Farmer field schools and meetings were regularly organized in the village at different time intervals to upgrade the knowledge of farmers about the pests infesting rainy season cauliflower. Farmers

were also trained how to prepare raise bed nursery, usage of *Trichoderma* in nursery and main field crop. They were also trained to identify the beneficial natural enemies and how to conserve them efficiently. Cultural and mechanical methods of pest management were also advocated and demonstrated to the farmers time to time. Demonstration on seed treatment and seedling root dip treatment with *Trichoderma*, field sanitation and weed removal was also conducted before the farmers. They were also trained on need based application of label claim safe pesticides. The project was implemented in active collaboration with KVK Shikohpur, Gurugram (Haryana). Strong linkages were developed among the farmers, scientists and extension workers of state Government. Mobile numbers of the farmers, scientists/extension workers were shared among themselves through WhatsApp group.



Seedlings on raised bed under IPM  
Seed rate 750g/ha (25% reduction  
over FP) and healthy nursery



Seedlings on flat beds & damaged by  
ater logging (Seed rate 1000g/ha)