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Integrated management of Black-rot disease of cauliflower in Orissa

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The efficacy of bacterial antagonists *Pseudomonas fluorescens* and *Azotobacter chroococcum*, chemical like streptocycline and a botanical neem cake were used for the management of black-rot disease of cauliflower. Field trials were conducted for three consecutive Rabi seasons 2001-02, 2002-03 and 2003-04 in the experimental field of All India Coordinated Vegetable Improvement Project, OUAT, Bhubaneswar with the variety Himlata-2. The trial was laid out in randomized block design with four replications. Among the different treatments, seed treatment with streptocycline (100 ppm) for 15 minutes followed by seedling dip (100 ppm) for 15 minutes before planting and three sprays of streptocycline (200 ppm) at 10 days intervals starting from 15 days after planting proved very effective in management of black-rot with mean PDI of 4.55%, maximum curd yield of 220.23 q/ha and registering 81.84% disease control and 75.71% increase in curd yield over control. The same treatment gave maximum cost benefit ratio of 1:10.85 with net return of Rs. 27,505.00. Seed treatment with *Azotobacter chroococcum* (1.5 g/kg), soil application of the culture (250 g/50 kg FYM/ha) and slurry culture drenching (after 15 days of planting) was found to be next best in respect of disease control (54.69%) followed by use of *Pseudomonas fluoroescens* as seed treatment (10 g/kg), seedling dip (0.2% spore suspension for 30 minutes before planting) and foliar spraying (three sprays of 0.2% spore suspension at 10 days interval starting from 15 days after planting) registered 37.71% disease control with mean cost benefit ratio of 1:5.68. However, the control plots recorded maximum disease incidence of 35.6% with lowest curd yield of 125.47 q/ha.

Key words : Cauliflower, black-rot, Integrated management

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.), which belongs to the family Cruciferae is an important vegetable grown throughtout the country. The edible portion of plant is the 'curd' which is made up of numerous divided hypertrophic branches which terminates in the main stem of the plant and is highly suppressed with no part of flower apparent there. Cauliflower is a herbaceous annual for vegetable production and biennial for seed production. It is rich in minerals like K, Na, Ca, Fe, P and Mg and vitamins like A and C. In Orissa, cauliflower is cultivated for vegetable purpose in almost all districts in 44932 ha with annual production of 6,36,653 tonnes accounting the productivity of about 14.17 tonnes/ha. This low productivity is attributed to the attack by many insect pests and diseases. Like many other crops, diseases make serious inroads into cauliflower production in terms of curd yield by affecting seed germination, seedling mortality, killing the plants, rotting of curds and spoiling the quality of curds.

The black-rot disease of cauliflower incited by *Xanthomonas campestris* pv. *campestris* (Pammel) Dowson is a bacterial disease causing considerable loss in curd yield. The management of black rot has increasingly become very difficult due to cultivation of susceptible varieties.

Studies on this disease have been undertaken in an integrated manner because of its greater impact on economic loss in the state. Taking into account the importance of the crop and occurrence of the disease, a chemical, a botanical and two promising

bacterial antagonists have been included in the field trials to evaluate and find out the most efficacious and economic ones for effective management of the pathogen.

MATERIALS AND METHODS

In order to study the efficacy of a chemical, bacterial antagonists and a botanical on the management of black-rot disease of cauliflower, field trials were conducted for 3 consecutive years during rabi 2001-02, 2002-03 and 2003-04 at the experimental field of All India Coordinated Vegetable Improvement Project, OUAT, Bhubaneswar, as per the treatments given below.

Number of treatments - 5 ;

T_1 — Hot water seed treatment for 30 minutes at 50°C temperature. Seed treatment with *Pseudomonas fluorescens* @ 10 g/kg seed followed by seedling dip in 0.2% cell suspension for 30 minutes before transplaning. Three sprays of the 0.2% cell suspension of *P. fluorescens* at 10 days interval starting from 15 days of transplanting. T_2 — Seed treatment with *Azotobacter chroococcum* @ 1.5 g/kg of seed followed by soil application of the culture of *A. chroococcum* along with 250 g/50 kg of FYM/ha followed by slurry culture of *A. chroococcum* drenching after 15 days of planting. T_3 — Seed treatment with streptocycline @ 100 ppm for 15 minutes followed by seedling dip @ 100 ppm of streptocycline for 15 minutes before planting and three sprays (200 ppm of streptocycline) at 10 days interval starting from 15 days after planting. T_4 — Soil application of neem cake in seed bed and in the field @ 150 kg/ha, and T_5 — Control.

The trial was laid out in randomized block design with four replications. The crop was planted on 5.12.2001, 14.11.2002 and 14.11.2003 with variety Himlata-2 in plot size of 8.1 sq.m. (3.0 m × 2.7 m) with row to row spacing of 60 cm and plant to plant distance of 40 cm. Agronomical practices as generally recommended were followed with the fertilizer dose of 100:50:50 kg :: $N:P_2O_5:K_2O$/ha.

The per cent disease incidence (PDI) and per cent disease control (PDC) were calculated.

Twenty five leaf samples were selected randomly in each treatment of the replications in order to record the disease incidence. The curds were harvested after proper maturity. The cumulative curd yields were calculated.

RESULTS AND DISCUSSION

It was revealed from Tables 1, 2 and 3 and Fig. 1 that, all the treatments were found to be significantly superior over control in reducing the black-rot incidence. Among the treatments, lowest disease incidence was recorded from the plots where seed treatment was done with streptocycline @ 100 ppm for 15 minutes followed by seedling dip @ 100 ppm of streptocycline for 15 minutes before planting and three sprays (200 ppm of streptocycline) at 10 days intervals starting from 15 days after planting (T_3) resulting in 81.84% disease control and 75.71% increase in curd yield over check plot. The same treatment registered maximum cost : benefit ratio of 1:10:85 accounting for net return of Rs. 27,505.00. The efficacy of streptocycline against *Xanthomonas* has successfully been proved earlier by different workers both in cabbage and cauliflower against *Xanthomonas campestris* pv. *campestris* (Shekhawat *et al.*, 1982) in cabbage (Gupta, 1991, Bora and Bhattacharyya, 2000), in mung bean against *Xanthomonas axonopodis* pv. *vignaradiatae* (Dhutraj and Kore, 2002) and in cotton against *Xanthomonas axonopodis* pv. *malvacearum* (Minakshi *et al.*, 2004) which are in agreement with the present investigations.

Seed treatment with *Azotobacter chroococcum* @ 1.5 g/kg of seed followed by soil application of the culture of *A. chroococcum* @ 250 g/ 50 kg FYM/ ha followed by slurry culture of *A. chroococcum* drenching after 15 days of planting (T_2) found to be the next best in order of efficacy in controlling the disease followed by seed treatment with *Pseudomonas fluorescens* @ 10 g/kg of seed, then seedling dip in 0.2% cell suspension of *P. fluoreseens* for 30 minutes before planting and three sprays of 0.2% cell suspension of *P. fluoreseens* at 10 days intervals starting from 15 days after planting (T_1). The lowest disease incidence resulted in maximum curd yield (220.23 q/ha) recorded in T_3. The treatment T_1 was second in respect of yield (175.10 q/ha) fol-

lowed by T_2(164.37 q/ha) which has given 39.71% increase in curd yield over control with cost : benefit ratio of 1:5.68 as compared to *Azotobacter chroococcum* (31.14%) with cost : benefit ratio of 1:4.26.

Table 1 : Incidence of black-rot of cauliflower as influenced by different treatments

Treatment	Per cent disease incidence				Per cent disease control
	2001-02	2002-03	2003-04	Pooled mean	
T_1 *Pseudomonas fluorescens*	20.15 (26.64)	12.09 (20.27)	14.6 (22.48)	15.61 (23.13)	37.71
T_2 *Azotobacter chroococcum*	15.06 (22.75)	9.23 (17.66)	9.8 (18.24)	11.36 (19.55)	54.69
T_3 Streptocycline	6.04 (14.05)	3.62 (10.94)	4.0 (11.38)	4.55 (12.12)	81.84
T_4 Neem cake	24.30 (29.49)	14.58 (22.38)	13.7 (21.76)	17.53 (24.54)	30.05
T_5 Control	33.31 (35.23)	19.28 (25.99)	22.6 (28.23)	25.6 (29.82)	-
C.D. at 5%	3.43	2.92	3.15	-	-

Table 2 : Average curd yield of cauliflower as influenced by different treatments

Treatments	Yield (q/ha)				% yield increase over control
	2001-02	2002-03	2003-04	Pooled mean	
T_1 *Pseudomonas fluorescens*	236.81	152.98	135.5	175.10	39.71
T_2 *Azotobacter chroococcum*	221.42	139.79	131.9	164.37	31.14
T_3 Streptocycline	283.39	192.91	184.4	220.23	75.71
T_4 Neem cake	202.22	123.34	118.8	148.12	18.17
T_5 Control	167.31	105.61	103.1	125.47	-
C.D. at 5%	5.94	8.35	6.65	-	-

Table 3 : Economics of Integrated Management of black-ort of cauliflower

Treatments	Excess produce over control (kg/ha)	Expenditure over control (Rs/ha)	Return over control		
			Gross	Net	MCBR
T_1 *Pseudomonas fluorescens*	49.76	1875.00	12525.00	10650.00	1:5.68
T_2 *Azotobacter chroococcum*	39.03	1432.00	7532.00	6100.00	1:4.26
T_3 Streptocycline	94.89	2535.00	30040.00	27505.00	1:10.85
T_4 Neem cake	22.78	1536.00	5289.00	3753.00	1:2.44
T_5 Control	-	-	-	-	-

The effectiveness of the bacterial antagonist *Pseudomonas fluorescens* has also been demonstrated by different workers in some other crops eg. cotton against *Xanthomonas axonopodis* pv. *malvacearum* (Sofiyazov *et al.*, 1995 ; Minakshi *et al.*, 2004), in rajmash against *Xanthomonas axonopodis* pv. *phaseoli* var. *fuscans* (Mondal, 2004) and in tomato against *Xanthomonas campestris* pv. *vesicatoria* (Wafaa and Ghafar, 2004) which are also in support with the present findings.

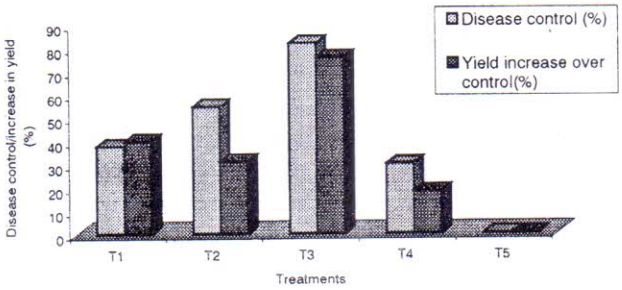

Fig. 1 : Per cent disease control and per cent yield increase over control of black-rot of cauliflower as influenced by different treatments

Thus, the black-rot of cauliflower was successfully managed by seed treatment with streptocycline @ 100 ppm for 15 minutes followed by seedling dip @ 100 ppm of streptocycline for 15 minutes before planting and three sprays (200 ppm of streptocycline) at 10 days intervals starting from 15 days after planting in Orissa condition.

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