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Evaluation of plant protection schedules for the management of major diseases and pests of cumin (*Cuminum cyminum* L.)

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Abstract

Field experiments were conducted during *rabi* seasons of 2009-10 and 2010-11 with cumin varieties RZ 209 and GC 4 to evaluate the disease and pest management schedules (Schedule I, Schedule II, Schedule III and Schedule IV). The schedule I (S1) comprised the recommended disease and pest management practices and Schedule IV (S4) comprised the organic treatments, whereas, Schedule II (S2) and Schedule III (S3) included new chemical molecules. The results showed that S2 comprised seed treatment with tabuconazole and alternate spraying with mancozeb and propiconazole coupled with spraying of acetamiprid, imidachloprid and dinocap resulted in significant reduction of blight, powdery mildew and aphids. It has also recorded highest seed yield (540 and 694 kg/ha) with increase in seed yield over untreated control by 157-192%. The S2 was followed by S3 where blight PDI and aphid population was reduced by 41-55% and 82-92% as compared to untreated control and increase in yield by 92-122%.

Keywords: Aphids,blight, cumin, diseases, spray schedule

Cumin (*Cuminum cyminum* L.) is an important seed spices crop and India ranks first in the world in term of the acreage cultivate with this crop and the annual production. In India it is mainly grown in Rajasthan and Gujarat states. Its growth is largely dependent upon the proper cultivation and protection of the crop. Cumin is frequently affected by diseases and insect pests. The diseases especiallyAlternaria blight (*Alternaria burnsii*), Fusarium wilt (*Fusarium oxysporum* f.sp. *cumini*), powdery mildew (*Erysiphe polygony*) are the major constraints for its low productivity (Dange *et al.* 4; Sharma *et al.* 11; Khare *et al.*8). Aphids (*Myzus persicae* and *Aphis gossypii*) thrips (*Thrips tabaci*) and mites (*Tetranychid lateens*) are major sucking insects which causes serious economic losses in cumin (Kant *et al.* 7). The diseases and pests attack on all plant parts from early growth stage (wilt) to flowering and seed formation stage (blight, powdery mildew and aphids) of the crop. Scattered and scanty information is available for the management of diseases and insect pests in cumin (Akbari *et al.* 1, Aghnoom *et al.* 2, Champawat and Pathak 3, Gupta and Yadava 5, Isreal and Lodha 6). However, proper schedule of the application of management practices are required for effective management of important diseases and insects. Therefore, present study was envisaged to work out the effective plant protection schedule for the management of diseases and insect pests.

Materials and methods

Fungicides, soil amendments and bioagents were applied as soil application (SA), seed treatment (ST) and foliar spray (FS) as per the treatment details given below.

S_1: Soil application of mustard cake@ 0.5 t / ha; Seed treatment with carbendazim @ 2.5 g/ kg; Soil drenching with carbendazim (0.1%) at 25-30 DAS; Foliar spray with mancozeb (0.2%) at 60, 75 , 90 and 105 DAS; Dusting with sulphur @ 25kg/ ha at 70 DAS; Foliar spray with dinocap (0.1%) at 85 and 100 DAI; FS neem insecticide 60-70 DAS; FS neem oil + endosulfan 70-80 DAS; FS thiomethoxam 80-90 DAS if required.

S_2: Soil application of neem cake + mustard cake@ 0.5 t / ha; Seed treatment with tebucanazole @ 2.5 g/ kg; Soil drenching with Metalaxyl+Mancozeb (0.1%) at 25-30 DAS; Foliar spray with mancozeb (0.2%) at 60 DAS and propiconazole (0.1%) at 75 and 90 DAS; Foliar spray with dinocape (0.1%) at 70, 85 and 100 DAS; FS acetamiprid 0.005% 60-70 DAS; FS imidachloprid 0.005% 70-80 DAS

S_3: Soil application of neem cake@ 0.50 t/ha ; Seed treatment with carbendazim + thiram (1:1) @ 2.5 g/ kg; Soil drenching with carbendazim 25-30 DAS; Foliar spray with mancozeb (0.2%) at 75 DAS and propiconazole (0.1%) at 90 DAS; Dusting with sulphur @ 25kg/ ha at 85 DAS; Foliar spray with dinocap (0.1%) at 100 DAS; Foliar

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spray dimethoate (0.003%) 60-70 DAS; Foliar spray carbosulphan (0.005%) 80-90 DAS

S_4: ST with *Trichoderma* @ 10g/kg seed; SA with *Trichoderma* (2.5 kg/ha) at sowing and 30 DAS; SA neem cake (0.50 t/ha) before sowing; Foliar spray NSKE (5%) + karanj oil (2%) from 60 DAS at 15 days interval; FS *V. lacani* @ 5g/lit. + neem insecticides 3000ppm @0.05% 70-80 DAS; FS neem oil (2%) + Karanj oil (2%) 90-100DAS

S_0: Control (Without application)

The experiment was conducted during *rabi* season in 2009-10 and 2010-11 using two popular varieties viz. GC 4 and RZ 209 in randomized block design with three replications. The experimental plot size was 3 × 4.2 m with row and plant spacing of 30 × 10 cm. Percent disease incidence of wilt was worked out by counting number of diseased and total number of plants. Blight and powdery mildew was scored from 20 plants selected randomly in each treatment and percent disease index was worked out. Foliar application of insecticides were applied at population level of 50 aphids/ plant or inflorescence. Number of insect population was recorded weekly on per plant or inflorescence from 5 randomly selected places in each treatment.

Results and discussion

The results during 2009-10 (Table 1) showed that schedule II (S2) was the best schedule with significant lowest PDI of blight (14.0 and 23.5% in RZ 209 (V1) and GC 4 (V2) respectively) and powdery mildew (0.0%). Similarly, reduction in the population of aphids (12.9 to 3.0 and 9.6 to 3.0 in V1 and V2) was also maximum in this schedule during the period. The seed yield was significantly higher (548 kg/ha and 676 kg/ha) in this schedule as compared to untreated control (Table 3). Untreated control resulted in highest disease and pest incidence and lowest seed yield. Schedule III (S3) brought about 41 to 45% and 82 to 88% reduction in blight and aphid population in V1 and V2. The yield was also found to be increased by 103 and 92% in schedule III.

During 2010-11 also, the same trend was observed although the aphids population was less (Table 2). Schedule II was again found to be significantly effective in reducing blight, powdery mildew and aphids population. The PDI of blight and powdery mildew in schedule II was 19.3-20.7 and 0.0% as against 52.0-65.7 and 15.8-23.3% in untreated control. The aphids population was also found to be significantly lower in schedule II than that in untreated control. The incidence of wilt was also reduced in this schedule as against higher incidence in untreated control. Schedule II also showed significantly higher seed yield (531 and 712 kg/ha), indicating 146-158% yield increase as compared to untreated control (Table 3).

Table 1: Incidence of cumin diseases and pests in different schedules (2009-10)

Variety /Schedule	Blight PDI		Powdery mildew PDI		Aphid population			
	V1	V2	V1	V2	V1		V2	
					Initial[a]	Final[b]	Initial[a]	Final[b]
S1	16.3	27.2	0.0	0.0	25.8	8.3	16.9	6.9
	(4.1)	(5.3)	(1.0)	(1.0)	(5.2)	(3.0)	(4.2)	(2.8)
S2	14.0	23.5	0.0	0.0	12.9	3.0	9.6	3.0
	(3.9)	(4.9)	(1.0)	(1.0)	(3.7)	(2.0)	(3.2)	(2.0)
S3	16.5	25.5	0.0	0.0	16.3	3.3	25.6	2.1
	(4.1)	(5.1)	(1.0)	(1.0)	(4.2)	(2.1)	(5.1)	(1.8)
S4	23.2	28.7	23.0	20.0	29.9	4.0	25.9	6.3
	(4.9)	(5.4)	(4.9)	(4.6)	(5.6)	(2.2)	(5.2)	(2.7)
S0 (Control)	28.0	46.2	26.2	26.0	33.9	19.0	35.1	18.4
	(5.4)	(6.9)	(5.2)	(5.1)	(5.9)	(4.5)	(6.0)	(4.4)
CD (P=0.05)	(0.80)		(0.30)		0.33	0.15	0.33	0.14

[a] Population of aphids at the time of 1st spray [b]population of aphids 7days after last spray

Figures in parentheses are transformed value

Table 2: Incidence of cumin diseases and pests in different schedules (2010-11)

Variety /Schedule	Blight PDI		Powdery mildew PDI		Wilt incidence (%)		Aphid population			
	V1	V2	V1	V2	V1	V2	V1		V2	
							Initial[a]	Final[b]	Initial[a]	Final[b]
S1	28.7	29.7	0.0	0.0	2.1	0.8	10.6	5.3	12.6	1.2
	(5.4)	(5.5)	(1.0)	(1.0)	(1.8)	(1.3)	(3.4)	(2.5)	(3.7)	(1.5)
S2	20.7	19.3	0.0	0.0	2.7	1.0	8.7	0.5	6.3	1.0
	(4.6)	(4.5)	(1.0)	(1.0)	(1.9)	(1.4)	(3.1)	(1.2)	(2.7)	(1.4)
S3	29.0	28.0	0.0	0.0	2.8	1.0	8.4	2.0	8.0	2.1
	(5.5)	(5.4)	(1.0)	(1.0)	(2.0)	(1.4)	(3.1)	(1.7)	(3.0)	(1.8)
S4	49.0	44.7	24.5	8.7	2.6	1.1	10.8	3.2	15.3	3.1
	(7.1)	(6.8)	(5.1)	(3.1)	(1.9)	(1.5)	(3.4)	(2.0)	(4.0)	(2.0)
S0 (Control)	65.7	52.0	23.3	15.8	6.8	2.5	11.0	27.8	12.3	26.1
	(8.2)	(7.3)	(4.9)	(4.1)	(2.8)	(1.9)	(3.5)	(5.4)	(3.6)	(5.2)
CD (P=0.05)	10.08 (0.92)		2.08 (0.24)		0.51 (0.12)		0.22	0.11	0.22	0.08

[a] Population of aphids at the time of 1st spray [b]population of aphids 7days after last spray

Figures in parentheses are transformed value

Table 3: Seed yield of cumin in different schedules (2009-10 and 2010-11)

Variety /Schedule	Yield Kg/ha					
	2009-10		2010-11		Mean	
	VI	V2	VI	V2	VI	V2
SI	465	354	354	511	410	433
S2	548	676	531	712	540	694
S3	520	506	438	615	479	561
S4	298	409	250	283	274	346
S0	256	263	115	276	186	270
CD(P=0.05)	59.56		133.8			

The overall results of two years experiments carried out during 2009-10 to 2010-11 revealed that the schedule II (Soil application of neem cake + mustard cake@ 0.5 t / ha, Seed treatment with tebucanazole @ 2.5 g/ kg, Soil drenching with metalaxyl (0.1%) at 25-30 DAS, foliar spray with mancozeb (0.2%) at 60 DAS and propiconazole (0.05%) at 75 and 90 DAS, foliar spray with dinocap (0.1%) at 70, 85 and 100 DAS, FS acetamiprid 0.005% 60-70 DAS and imidachloprid 0.005% 70-80 DAS) reduced blight PDI and aphid population by 56-63% and 90-91% over untreated control, 23-25% and 56-74% over schedule I (S1), 20-24% and 5-33% over schedule III (S3), and 42-52% and 50-57% over schedule IV (S4).Seed dressing and soil drenching with thiophanate methyl and carbendazim decreased the wilt incidence and increased yield. Champawat and Pathak, (3) and Patel and Patel (10) observed that insecticides and herbicides application

showed effective for reduction in wilt pathogen of cumin. Powdery mildew can be controlled with application of sulphur dust at the time of flowering in the month of January and spraying with dinocap (0.1%) (Mathur *et al.* 9). Four sprays of mancozeb (0.2%) have been recommended for effective control of blight disease in Gujarat (Akbari *et al.* 1).

It is conclusively proved that cumin diseases and insects can be managed successfully and yield can be increased by adopting proper schedule involving soil application of oil cakes, seed treatment and foliar application of newer fungicide and insecticide molecules.

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