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Comparison of Single and Double Spray of Fungicides on the Rate of *Ascochyta* Blight, Area under the Disease Progress Curve and Yield of Chickpea Cultivars

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Abstract

Single or Double Application @ 0.2 per cent of Tilt, Daconil, Score-250 and Topaz C-50 suppressed the rate of gram bli disease development and reduced AUDPC compared to untreated control. None of the fungicides applied once or tw completely inhibited the symptom development. Score-250 was the most effective fungicide followed by Daconil, Tilt a Topas C-50 in that order, whether applied singly or twice. Except significantly less disease severity in plots of CM- receiving double foliar spray of Tilt or Topas C-250, the differences in mean disease severity of most of the treatme (single or double spray) compared to untreated control were statistically not significant. Statistically significant yi enhancement was recorded in plots of Paidar-91 receiving single spray of Daconil. Most of the treatments resulted positive effects on yield of CM-72, CM-88 and C-727 receiving double spray of fungicides. However, the increases in yi of most of the treatments compared to untreated control or double spray compared to single spray was not signific statistically.

Introduction

Chickpea blight caused by *Ascochyta rabiei* (Pass) Lab. appears in Feb-March, progresses in April and induces significant yield losses depending upon the cultivation of susceptible germplasm and favorable environmental conditions for disease development. Several epidemics of this disease have been reported in the past (Sattar, 1933; Kausar, 1958; 1960; 1965; Mitsueda *et al.*, 1997). Due to lack of durable resistance in the available high yielding commercial varieties against diverse virulences of *A. rabiei*, blight of chickpea will continue to be a major threat to this crop in future. Chickpea blight management strategies include cultivation of disease tolerant varieties and use of seed and foliar application of fungicides. Chemical control of gram blight has been reported by several research workers (Bashir and Ilyas, 1984; Bashir *et al.*, 1987; Iqbal, *et al.*, 1991; Mitseuda *et al.*, 1997a&b). However, extensive use of fungicides may not be economical and beneficial for the environment. The frequency of fungicides can be minimized with their timely application on moderately resistant to moderately susceptible varieties. Currently fungicides are applied at the initial appearance of disease symptoms and a suitable crop growth stage. Timing of fungicide application is critical in managing disease and enhancing yield. Objective of these studies was to compare the single and double spray of fungicides applied at the initial appearance of disease symptoms and before pod formation. Results of this study may be helpful to decide the correct time of fungicide application.

Materials and Methods

Experimental plots of CM-72, CM-88, Paidar-91 and C-727 were established in a randomized complete block design in the Rabi season of 1996-97 at the research area of Department of Plant Pathology, University of Agriculture, Faisalabad. The varieties were established in compl blocks with three replications and the treatments w applied randomly. The plots were artificially sp inoculated with spore suspension of *Ascochyta ra* prepared by mass culturing technique, described by Il and Khan (1986). In order to provide most favora conditions for disease development, a spreader row o highly susceptible variety C-727 was sown around the p and sprayed by tap water twice a day for the availability sufficient moisture and successful infection by the fung The inoculum spray was applied every day in the evening the appearance of blight symptoms on highly suscepti cultivars. From each plot ten plants were selected rando and disease severity was recorded at three days inte using a disease rating scale described by Reddy and Ne (1979). The disease severity data were subjected regression analysis and slopes of mean disease seve were compared by using the "contrast" statement Statistical Analysis System software (Anonymous, 199 The crop was harvested at physical maturity stage and yield data obtained from each plot was subjected analysis of variance (Steel and Torrie, 1986; Anonym 1992). The fungicide treatments were compared untreated control and single or double spray of fungi was compared by Least Significant Difference Test (LSD P = 0.05.

Results and Discussion

Chickpea blight disease symptoms were recorded firs leaves of C-727 during 1st week of March, 1997, a hi susceptible variety to *Ascochyta rabiei*. The dis symptoms were delayed in case of CM-72 until 2nd w of March. Gram blight flared up in the first week of A and attained maximum severity values. No disease ra

Treatments	Paidar-91 $y = \beta_0 + \beta_1 x$	R^2	AUDPC	CM-88 $y = \beta_0 + \beta_1 x$	R^2	AUDPC	CM-72 $y = \beta_0 + \beta_1 x$	R^2	AUDPC	C-727 $y = \beta_0 + \beta_1 x$	R^2	AUDPC
Single spray												
Untreated control	-18.24 + 5.24x	0.67	183.73	-6.39 + 1.88x	0.79	92.34	-17.91 + 5.46x	0.80	560.32	- 4.98 + 1.27x	0.57	480.76
Tilt	-13.32 + 3.45x*	0.53	35.92	-1.29 + 0.37x*	0.75	151.99	-2.07 - 0.62x*	0.77	62.26	-7.66 + 1.97x*	0.59	268.47
Daconil	-2.87 + 0.76x*	0.58	10.68	-0.38 + 0.11x*	0.59	12.48	-3.25 + 0.97x*	0.79	96.34	-0.75 + 0.18x*	0.37	62.47
Score-250	-2.63 + 0.70x*	0.60	10.41	-0.41 + 0.12x*	0.58	14.62	-2.33 + 0.69x*	0.78	67.77	-0.87 + 0.21x*	0.50	57.27
Topaz C-50	-15.19 + 3.94x*	0.60	59.49	-2.01 + 0.59x*	0.75	55.63	-3.65 + 1.06x*	0.68	101.28	-3.22 + 0.80x*	0.50	305.29
Double spray												
Untreated control	-8.46 + 13.50x	0.88	184.81	6.82 + 2.66x	0.72	71.04	27.30 + 5.20x	0.69	526.50	-3.99 + 3.32x	0.86	385.68
Tilt	-9.76 + 10.24x*	0.70	24.19	1.41 + 0.18x*	0.36	131.40	3.09 + 0.34x*	0.41	50.40	-4.98 + 5.22x*	0.81	260.83
Daconil	-1.57 + 1.84x*	0.84	13.89	0.46 + 0.06x*	0.09	12.45	5.26 + 0.47x*	0.71	81.36	-0.68 + 0.56x*	0.42	48.88
Score-250	-1.18 + 1.65x*	0.85	8.05	0.40 + 0.08x*	0.10	14.19	3.45 + 0.27x*	0.28	51.88	-0.87 + 0.68x*	0.76	46.69
Topaz C-50	-10.68 + 11.89x*	0.78	40.15	2.69 + 0.20x*	0.12	41.43	6.06 + 0.02x*	0.03	75.19	-2.14 + 1.85x*	0.62	312.03

*Indicates that slope of mean disease severity is significantly different from untreated control at P = 0.05.

Table 2: Effect of foliar applied fungicides on mean disease severity and yield of four chickpea varieties.

Treatments	Gram blight disease severity											
	Paidar-91			CM-88			CM-72			C-727		
	Single spray	Double spary	LSD	Single spray	Double spray	LSD	Single spray	Double spray	LSD	Single spray	Double spray	LSD
Untreated control	35.26 a*	32.06 a	16.64	41.83 a	42.90 a	6.39	14.82 a	13.88 a	3.31	7.78 a	5.97 a	4.58
Tilt	21.79 a	20.97 a	14.04	4.72 a	4.14 a	0.75	2.74 a	1.97 b	0.57	12.45 a	10.69 a	6.99
Daconil	4.94 a	3.96 a	2.63	7.25 a	6.68 a	1.17	0.82 a	0.64 a	0.29	1.10 a	1.02 a	1.06
Score-250	4.52 a	3.76 a	2.36	5.14 a	4.28 a	0.87	0.83 a	0.65 a	0.34	1.29 a	1.19 a	0.94
Topas C-50	25.01 a	24.96 a	14.82	7.74 a	6.13 a	2.15	4.49 a	3.29 b	0.85	4.85 a	3.42 a	3.20
						Yield (g/plot)						
Untreated control	300.00 a	240.00 b	42.41	566.67 a	476.67 a	167.10	483.33 a	450.00 a	201.70	473.33 a	491.67 a	141.95
Tilt	306.67 a	273.00 a	150.09	408.33 a	488.33 a	143.08	416.67 a	533.33 a	130.88	406.70 a	506.70 a	317.64
Daconil	483.37 a	400.00 b	64.78	501.67 a	566.67 a	102.54	550.00 a	566.67 a	122.43	575.00 a	663.33 a	203.76
Score-250	506.67 a	450.00 a	261.11	575.00 a	633.33 a	100.21	450.00 a	483.33 a	146.33	508.33 a	581.67 a	179.70
Topas C-50	406.67 a	326.67 a	191.47	503.33 a	633.33 a	84.31	433.33 a	510.00 a	264.05	415.00 a	458.33 a	93.24

*Mean values sharing similar letter in a column are statistically not significant at P = 0.05

could be taken during 3rd week of April due to the necrosis of leaves. Based on disease rating scale C-727 and CM-88 were highly susceptible and CM-72 and Paidar-91 were moderately susceptible. The moderately susceptible to highly susceptible response of these varieties indicates scarcity of resistance and it may be attributed to the prevalence of diverse virulences of *A. rabiei* as reported by Hussain and Malik (1991), Yousaf et al. (1993) and Mitseuda *et al.*, (1997a).

The slopes of mean disease severity were significantly higher in untreated control plots of all the four cultivars (Table 1). Experimental plots treated with fungicides had significantly lower rate of disease development as indicated by the slopes of mean disease severity. Chickpea blight after initiation continued to increase in all treatments of four cultivars. This increase although showed a linear trend was not perfectly linear as indicated by the lower R^2 values in most of the varieties. Thus the disease appeared to increase in short infectious periods leading to epidemic stage. Kausar (1965) compared the epiphytotics of chickpea blight in 1956-57 and 1958-59 in West Pakistan, and indicated that the time of initiation and development of blight depended on the availability of abundant inoculum of *A. rabiei* and spells of rains which provided conditions favorable for the initiation and development of the disease. According to Sattar (1933) occurrence of blight during 1919-20, 1922-23 and 1927-28 was influenced by the amount of winter rainfall received particularly during the flowering and fruiting periods of gram. In the current studies rainfall varied between 4 and 6 mm during 2nd and 3rd week of March. However, during 1st week of April a total of 52 mm rainfall was recorded and disease increased rapidly as an indirect effect of availability of moisture. Rainfall occurred again in the 3rd week of April but at that time crop was reaching towards maturity and very less amount of host plant tissue was left for the fungus to invade.

Slopes of mean disease severity were reduced further as a result of second spray of test fungicides (Table 1). But this trend was not uniform in all the fungicides and chickpea cultivars. In other words cultivars responded differently to fungicide treatments. All the fungicides, when applied twice had lower slopes of mean disease severity compared to the slopes when applied once on CM-88 and CM-72. Slopes of mean disease severity increased by the double application of these fungicides on C-727 and Paidar-91 compared to single application. Thus the genetic potential of these varieties was greatly exploited in reducing disease severity by fungicides treatments compared to untreated control. Except for Tilt application (single or double) the area under the disease progress curve (AUDPC) was lower in all other fungicide treatments applied on four cultivars compared to untreated control. However, AUDPC was even higher in Tilt applied plots compared to untreated control. This can be explained by one of the assumptions of regression which states that independent variable is measured without error (Steel and Torrie, 1986). AUDPC, calculated using subjective disease assessments may not be as accurate disease severity. Disease severity was measured randomly selected plants based on the assumption th distribution of blight in a population was homogenou However, blight severity measurements used to calcula AUDPC, did not account for spatial heterogeneity in bligh distribution. Increased disease observations and accura measurement with computer image analysis could increa the preciseness of these data and avoid error due to huma oversight used to measure disease severity based severity scale. Keeping in view the rate of disea development and AUDPC Score-250 was the most effecti fungicide followed by Daconil, Tilt and Topas C- respectively. Effectiveness of these fungicides again Ascochyta blight of chickpea has already been report (Bashir and Ilyas, 1983; Ilyas and Bashir, 1984 a & b; H *et al.*, 1995). Mitseuda *et al.* (1997) reported that coati of seed with Calcium sulfate calcinoid after treating th with Benlate-T was also effective to control the prim infection of Ascochyta blight of chickpea.

Consistently low disease severity in fungicide treated pl was reflected in yield increases of four cultivars compa to untreated control (Table 2). Despite of non-signific differences in mean disease severity of fungicide trea plots compared to untreated control there were positi effects on yield in all the treated plots. This was conside to be the activity of the tested fungicides against *A. ra* which was ultimately reflected in terms of yi enhancement of chickpea cultivars. Comparing the sin spray of fungicides with double spray, yield increases w more pronounced in case of double spray on CM-88, CM and C-727. In case of Paidar-91 yield reduction w recorded with double spray of the fungicides. Paidar-9 moderately resistant to moderately susceptible variety profitable yield may be obtained from this variety by sin spray of Score-250 or Daconil. In case of CM-88 and 72, number of sprays and their timing of application n further investigation. Probably an early spray of suita protectant and second spray of a systemic fungicide at time of initiation of disease symptoms and third spray protectant/eradicant depending upon the disease sever crop growth stage, and conducive/non-conduc environmental conditions may be helpful in manag chickpea blight economically.

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