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Research Article
Optimization of the Spray Schedule in Management of Ascochyta Blight (*Ascochyta rabiei* L.) of Chickpea (*Cicer arientinum* L.)

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Abstract
Objective: The efficacy of timing foliar sprays with azoxystrobin and difenoconazole in control of ascochyta blight (*Ascochyta rabiei* L.) was evaluated in field trials conducted at Agricultural Training Centre Koibatek and Egerton University, Njoro. **Methodology:** The experiments were laid out in a split-split plot design with three replications arranged in a randomized completely block design. Plots were sprayed 2-6 times in the sub plots at five stages of chickpea growth; seedling, early vegetative, late vegetative, flowering and podding stages. In the sub-sub plots, asymptomatic chickpea seeds were left treated or untreated with either azoxystrobin or difenoconazole fungicides. Data on disease incidence and severity were collected and subjected to analysis of variance following general linear model procedure in SAS. Significant means at F-test were separated using Tukey's test statistics at $p \leq 0.05$. **Results:** Fungicides applied as foliar sprays were more effective in suppressing disease incidence and severity than seed dressing alone. There was significant reduction in incidence and severity following multiple foliar applications of 3-6 times compared to control. Percent disease incidence reduced by 65.5, 62.25, 40.55 and 33% in Njoro and 52.8, 49.63, 51.41 and 22.64% in Koibatek following application of 6, 5, 4 and 3 foliar sprays, respectively compared to control. Seed dressing was effective in delaying initial disease incidence and reducing severity at early stages of development but lacked advantage over foliar spraying alone in later stages of chickpea growth. **Conclusion:** Cultivation of susceptible chickpea cultivars in Kenya under high disease pressure environment may require 5-6 foliar sprays with either azoxystrobin or difenoconazole while 3-4 foliar sprays with either of the two fungicides are required for effective management under low disease pressure.

Key words: Ascochyta rabiei, seed dressing, foliar sprays

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Ascochyta blight (AB), caused by *Didymella rabiei* (Kovacheski) var., Arx [Anamorph *Ascochyta rabiei* (Pass) Labr.] is one of the most important diseases of chickpea (*Cicer arientinum* L.) and has been reported in most chickpea growing countries of the world[1]. In Kenya, the disease has been reported to cause yield losses of upto 100% on susceptible cultivars and upto 10% on resistant ones. The disease development and spread is favored by cool and wet conditions common during long rains in the Kenya and winters in the temperate regions[2,3]. The disease is primarily spread by ascospores discharged from pseudothecia during periods of rains but can also be spread by splash dispersal and seed[4]. Seed borne inocula has been responsible for introduction of ascochyta blight in new regions of the world such as Australia, Canada, Iran and the USA[5]. Seed infected with *A. rabiei* is usually discolored, shrinkled with low seed weight.

The fungus produces characteristic necrotic lesions on all foliage parts causing collapse of tissue, stem breakage and plant death[6]. The disease is particularly problematic to control because of the high variability of the *A. rabiei* caused by emergence of new races or pathotypes arising from sexual recombination of the mating types[7]. Deployment of resistant cultivars of chickpea along with seed treatment and foliar application of fungicides are a common recommendations for ascochyta blight management[8,9]. However, owing to the high variability of the pathogen, resistant cultivars alone cannot provide adequate management of the disease[2]. Moderately resistant to resistant cultivars at seedling stage become susceptible at older stages of growth as resistance declines over time[10]. In the light of this, foliar fungicides spray or seed-dress in an integrated scheme remains the most viable option in the management of AB in chickpea. Cultural practices such as planting disease free seeds, crop rotation and destruction of infected stubble are also viable alternatives in preventing new introductions and spread of AB.

Many fungicides have been tested and used for foliar application in chickpea as well as seed dressing but efficacy varies from region to region and season to season. Some of the effective fungicides that have been used include azoxystrobin, difenoconazole, chlorothalonil, mancozeb, boscalid, pyclastrobin and tebuconazole[11]. Chlorathalonil and azoxystrobin are widely used in many coutries and one of them could be used depending on availability and cost[12]. Levels of efficacy of these fungicides have been reported in controlling the pathogen depending on the level of host resistance, fungicide efficacy, disease pressure, foliar coverage and weather conditions. Effective control of AB has been achieved by multiple applications of foliar fungicides of upto five times during the period of chickpea growth[2]. Fungicide foliar sprays are sometimes uneconomical especially because a minimum of 4-6 foliar sprays are needed for effective control of AB[13]. In some regions however, a single foliar fungicide spray at vegetative or flowering stages have helped reduce AB severity, pod and seed infection[2,12]. Limited resistance in existing chickpea germplasm in Kenya has prompted the integration of judicious application of fungicides and host tolerance in Integrated Disease Management (IDM) of ascochyta blight. The objectives of this study therefore were to, (a) Determine the efficacy of azoxystrobin and difenoconazole and their timing effects to control ascochyta blight and (b) Determine effect of combining seed dressing and foliar sprays in an integrated disease management program. This information is important for integrated ascochyta blight disease management strategies on susceptible chickpea cultivars especially in Kenya and the East Africa region.

MATERIALS AND METHODS

Experimental sites: Field trials were conducted at Egerton University, Njoro (0°23'S and 35°35'E) and Agricultural Training Center-Koibatek (1°35'S, 36°66'E). ATC-Koibatek lies at an altitude of 1890 m a.s.l., in the agro-ecological zone upper midlands (UM4), with low agricultural potential. Average annual rainfall is 767 mm while mean temperatures ranges between 18.2-24.3°C. The mean annual minimum and maximum temperature are 10.9 and 28.8°C, respectively[14]. Egerton University, Njoro lies at an altitude 2265 m a.s.l., in the lower highland (LH2-LH3) agro-ecological zone and has a sub-humid modified tropical climate. The annual average rainfall is 931 mm and mean temperature ranges between 16-19.1°C. The mean maximum and minimum temperature are 22.7 and 7.9°C, respectively. Coupled with the fact that the selected fields had been under chickpea crop for more than 3 years, these conditions provided a suitable environment for spread and development of *A. rabiei*. The experiments were carried out during the 2014/2015 cropping seasons. A susceptible chickpea variety Chania Desi 1 (ICCV 97105), currently released by Egerton University (2013) and selected for its agronomic adaptation and high yield production in the dry highlands of Kenya was used.

Experimental design: A split-split plot design was used in the experiments at all locations with the fungicides as the main plots, seed treatment as sub plots and spray schedule (timing) as sub-sub plots in a randomized complete block design with three replications. Seeds were hand planted at a depth of 3-5 cm a spacing of 40×10 cm in five rows on plots measuring 3 m long. The following schedules of fungicide application were evaluated at the two locations: (1) Untreated control-no fungicide applications, (2) Two times spray-two fungicide applications at 22 Days After Emergence (DAE) and 36 DAE (3) Three times spray-three fungicide applications at 22, 36 and 50 DAE (4) Four times spray-four fungicide applications at 22, 36, 50 and 64 DAE (5) Five times spray-five fungicide applications at 22, 36, 50, 64 and 78 DAE and (6) Six times spray-six fungicide applications at 22, 36, 50, 64, 78 and 92 DAE. The fungicides azoxystrobin and difenoconazole were accordingly sprayed at recommended rates using a knapsack sprayer delivering about 200 L ha^{-1}. Normal agronomic practices for chickpea including fertilizer application and weed control were followed.

Disease assessment: Data on severity was collected by scoring the percentage of damage on individual plant using a scale of 1-9[15-17]. A total of 75 plants in three middle rows were scored for severity in each plot. Disease Severity Index (DSI) similar to that one used by Montaser was calculated[18] for each plot as follows:

$$DSI = \Sigma d/(d\ max \times n) \times 100$$

where, d is the disease rating of each plant, d max is the maximum disease rating and n is the total number of plants examined in each plot.

Percentage Disease Incidence (PDI) was measured based on the number of diseased plants per plot in three middle rows. Percent incidence was calculated as the ratio of the diseased plant to the total plant multiplied by 100%. The following equation was used to calculate the disease incidence of each plot as adopted from Amadioha[19]:

$$PDI = \frac{\text{No. of diseased plants}}{\text{Total No. of plants}} \times 100$$

Disease Severity Index (DSI) and Percent Disease Incidence (PDI) data were subjected to analysis of variance following PROC GLM procedure in SAS. Significant means at F-test were separated using Tukey's test statistics at $p \leq 0.05$.

RESULTS AND DISCUSSION

Effect of azoxystrobin and difenoconazole on ascochyta blight incidence and severity: Ascochyta blight proved to be very damaging in these experiments, causing extensive girdling of stems and subsequent breakage and death. Both disease incidence and severity were higher ($p \leq 0.05$) at Njoro compared to Koibatek (Table 1). This might have been favored by the higher rainfall and cooler temperatures that characterizes Egerton-Njoro. Previous studies have shown that high rainfall as well as low temperatures favors spread and development of ascochyta blight[2,4,16]. Azoxystrobin was more efficacious than difenoconazole in reducing disease severity

Table 1: Effect of fungicides spray schedule on ascochyta blight incidence and severity in Njoro and Koibatek in 2014

	Percent Disease Incidence (PDI)		Disease Severity Index (DSI)	
Fungicide	Njoro††	Koibatek††	Njoro††	Koibatek††
Azoxystrobin	74.95±2.94	40.96±2.30	49.77±2.52	30.63±2.14
Difenoconazole	81.33±2.72	51.26±2.42	55.35±2.49	45.12±2.46
Spray regime				
2 times	96.44±4.48	59.31±4.62	81.35±3.95	51.04±4.52
3 times	83.04±5.32	43.62±3.90	54.06±4.07	27.32±2.80
4 times	72.54±5.39	32.08±3.31	46.51±4.08	22.27±2.84
5 times	61.08±4.49	34.55±2.98	24.81±2.26	24.05±2.60
6 times	53.62±3.97	29.14±2.72	21.56±2.04	20.88±3.61
Control	100±0	77.95±4.14	87.06±3.29	73.68±4.34
Seed treatment				
No treated	79.01±2.90	46.46±2.36	53.46±2.52	36.83±2.31
Treated	77.28±2.77	45.76±2.40	51.66±2.50	38.91±2.38
Stage				
INCID 22	17.70±2.39	2.88±0.43	4.60±0.82	1.01±0.16
INCID 36	48.36±6.69	18.28±3.11	30.70±4.94	8.97±1.81
INCID 50	83.29±5.85	29.39±3.65	47.93±4.79	23.46±3.75
INCID 64	100±0	53.47±3.52	70.15±3.58	46.08±4.08
INCID 78	94.54±1.45	67.31±3.58	70.66±3.57	53.55±3.98
INCID 92	96.31±1.03	73.57±3.20	69.78±3.55	63.06±3.76

††Values shown are the Means±SE of three replicates. Values within a column whose SE values do not overlap are statistically different at $p \leq 0.05$

and incidence in both locations. Multiple foliar fungicide applications (3-6 foliar sprays) significantly reduced disease incidence and severity in both locations, except for application of only two foliar sprays in Njoro. There was no significant ($p \le 0.05$) difference in seed dressing with the two fungicides in both locations. There was significant ($p \le 0.05$) difference in disease incidence and severity at different stages of growth with the highest severity recorded at 92 DAE, 69.78 and 63.06% in Njoro and Koibatek, respectively and the lowest at 22 DAE, 4.60 and 1.01% in Njoro and Koibatek, respectively.

Effect of fungicide spray schedules on percent incidence and severity at different growth stages: The spray regimes with either azoxystrobin or difenoconazole resulted in significant differences ($p \le 0.05$) in PDI and DSI compared to control at different growth stages across the two locations (Table 2, 3). The spray schedules and stage of crop growth also indicated significant differences in DSI among the various treatments (Table 3). There were however, no significant differences in mean DSI of seed dressing against control. Azoxystrobin had significantly lower mean DSI (49.77%) than difenoconazole (55.35%) in Njoro and 30.63 and 45.12%, respectively. Disease severity was lowest (21.56 and 20.88% in Njoro and Koibatek, respectively) under the six-spray schedule in both locations (Table 3). Disease severity and incidence increased steadily with time across the two locations and reduced with increasing number of sprays for both fungicides (Table 2, 3). There was no significant difference in severity

Table 2: Effect of fungicides spray schedule at different stages of chickpea growth at Njoro and Koibatek in 2014

		Percent Disease Incidence (PDI)			
		Azoxystrobin		Difenoconazole	
Spray schedule	Stage	Njoro[††]	Koibatek[††]	Njoro[††]	Koibatek[††]
2 times	INCID22	15.48±5.52	3.50±1.12	14.39±6.13	5.50±1.52
	INCID36	100.00±0.00	10.67±3.22	100.00±0.00	17.50±3.77
	INCID50	100.00±0.00	18.00±5.55	100.00±0.00	23.17±4.94
	INCID64	100.00±0.00	76.00±11.29	100.00±0.00	81.67±6.01
	INCID78	100.00±0.00	94.33±5.67	100.00±0.00	100.00±0.00
	INCID92	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00
3 times	INCID22	11.23±5.50	5.33±2.16	16.60±6.65	1.00±0.68
	INCID36	11.16±3.53	7.83±2.15	59.67±24.54	10.17±4.17
	INCID50	87.68±12.32	22.67±4.02	100.00±0.00	25.17±8.56
	INCID64	100.00±0.00	38.33±6.74	100.00±0.00	52.83±6.78
	INCID78	100.00±0.00	58.50±13.63	100.00±0.00	80.50±12.37
	INCID92	100.00±0.00	65.17±11.51	100.00±0.00	83.50±10.44
4 times	INCID22	8.50±4.71	2.67±2.08	11.70±4.39	1.00±0.52
	INCID36	4.98±1.53	5.50±3.07	6.47±2.08	6.17±2.43
	INCID50	35.13±7.06	10.00±4.74	85.14±19.08	11.17±6.40
	INCID64	100.00±0.00	24.50±3.26	100.00±0.00	42.83±12.76
	INCID78	100.00±0.00	38.83±4.73	100.00±0.00	57.83±11.56
	INCID92	100.00±0.00	44.83±3.96	100.00±0.00	71.83±11.08
5 times	INCID22	11.57±2.87	2.50±1.63	7.66±2.63	4.83±1.54
	INCID36	7.33±1.11	3.00±1.15	10.15±1.40	12.50±3.82
	INCID50	32.50±14.56	15.33±3.22	60.56±9.08	21.33±5.44
	INCID64	68.51±13.34	32.83±4.59	100.00±0.00	41.17±5.83
	INCID78	77.78±7.38	43.17±3.78	100.00±0.00	54.33±7.33
	INCID92	88.67±5.48	51.83±6.99	100.00±0.00	71.00±9.49
6 times	INCID22	6.79±2.27	1.67±0.80	7.94±3.55	2.00±0.93
	INCID36	5.99±2.23	4.67±1.69	11.01±3.38	16.17±4.83
	INCID50	29.58±10.81	9.83±3.30	48.55±7.97	19.33±4.98
	INCID64	64.42±11.37	20.33±3.82	63.94±6.94	46.17±9.70
	INCID78	84.00±7.38	29.17±1.30	76.00±6.41	51.00±8.78
	INCID92	89.78±4.84	38.00±2.48	81.11±4.86	56.67±7.41
Control	INCID22	44.76±9.52	1.00±0.45	55.83±11.15	3.50±2.19
	INCID36	100.00±0.00	41.83±18.81	100.00±0.00	83.33±5.27
	INCID50	100.00±0.00	85.00±15.00	100.00±0.00	91.67±5.27
	INCID64	100.00±0.00	93.33±6.67	100.00±0.00	91.67±5.27
	INCID78	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00
	INCID92	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00

[††]Values shown are the Means±SE of three replicates. Values within a column whose SE values do not overlap are statistically different at $p \le 0.05$

Table 3: Effect of fungicide spray schedule on disease severity at different stages of chickpea growth at Njoro and Koibatek in 2014

		Disease Severity Index (DSI)			
		Azoxystrobin		Difenoconazole	
Spray schedule	Stage	Njoro††	Koibatek††	Njoro††	Koibatek††
2 times	DSI22	4.02±1.62	1.23±0.45	3.46±1.66	2.05±0.57
	DSI36	61.06±17.83	4.07±1.29	88.89±5.74	8.12±2.32
	DSI50	81.48±11.71	9.58±3.36	100.00±0.00	16.25±4.28
	DSI64	100.00±0.00	58.15±9.59	100.00±0.00	83.46±5.48
	DSI78	100.00±0.00	70.49±9.71	100.00±0.00	90.74±4.46
	DSI92	100.00±0.00	83.33±6.25	100.00±0.00	98.15±1.85
3 times	DSI22	1.70±0.71	1.90±0.85	3.63±1.43	0.30±0.20
	DSI36	2.44±0.61	2.99±1.02	18.99±8.08	4.12±1.92
	DSI50	28.27±9.14	12.25±2.59	75.93±8.32	14.27±5.30
	DSI64	70.37±8.45	20.42±4.26	83.33±7.45	35.11±6.14
	DSI78	72.22±8.49	30.57±8.08	83.33±7.45	47.09±7.89
	DSI92	74.07±8.45	40.94±8.48	77.78±9.51	58.12±10.00
4 times	DSI22	1.60±0.97	0.89±0.71	2.32±0.87	0.35±0.18
	DSI36	1.01±0.45	2.27±1.39	1.41±0.46	2.22±1.06
	DSI50	8.49±2.06	6.10±3.70	30.74±7.66	6.35±3.80
	DSI64	68.52±9.69	14.25±3.93	83.33±4.76	29.90±10.85
	DSI78	70.37±8.92	20.77±4.48	81.48±4.68	41.28±11.36
	DSI92	70.37±8.92	25.73±4.65	72.22±6.25	57.19±11.89
5 times	DSI22	2.37±0.64	0.81±0.55	1.46±0.53	1.78±0.64
	DSI36	1.65±0.48	0.89±0.34	2.25±0.31	5.56±2.56
	DSI50	10.77±6.81	7.38±1.97	17.65±2.01	13.75±4.23
	DSI64	31.78±6.01	18.47±3.26	41.41±3.04	29.85±6.52
	DSI78	30.20±7.01	20.42±2.42	48.89±4.80	43.93±8.84
	DSI92	32.42±6.38	31.63±6.03	41.33±5.86	60.62±6.74
6 times	DSI22	1.46±0.55	0.59±0.28	1.38±0.61	0.59±0.28
	DSI36	1.31±0.68	1.38±0.50	2.32±0.77	5.68±2.22
	DSI50	10.22±5.70	4.96±2.00	11.60±2.30	19.48±8.09
	DSI64	34.89±6.20	12.30±3.45	28.20±4.33	58.79±14.24
	DSI78	34.25±6.61	19.06±4.62	27.19±3.73	61.95±14.36
	DSI92	41.48±8.28	30.59±8.03	27.65±3.94	70.44±14.18
Control	DSI22	13.26±3.07	0.37±0.20	18.59±5.37	1.26±0.86
	DSI36	87.04±8.80	20.27±9.68	100.00±0.00	50.00±3.80
	DSI50	100.00±0.00	71.11±15.50	100.00±0.00	100.00±0.00
	DSI64	100.00±0.00	92.22±7.78	100.00±0.00	100.00±0.00
	DSI78	100.00±0.00	96.30±3.70	100.00±0.00	100.00±0.00
	DSI92	100.00±0.00	100.00±0.00	100.00±0.00	100.00±0.00

††Values shown are the Means±SE of three replicates. Figures within a column whose SE values do not overlap are statistically different at $p \leq 0.05$

compared to control when fungicides were sprayed two times at Egerton-Njoro. Additionally, there was higher than 50% severity at the same location when three sprays were applied. At Koibatek however, a three spray application of either fungicide was able to maintain disease severity below 30%. Koibatek is relatively drier and temperature is relatively higher favoring slow development of disease. However, application of two or three fungicide sprays of either azoxystrobin or difenoconazole may not be effective in controlling ascochyta blight at either of the two locations.

Azoxystrobin was superior to difenoconazole in reducing ascochyta severity and incidence at all growth stages, except seedling, across the two locations. Its effectiveness in controlling this disease has been reported in other findings[5,20]. Application of fungicides made at seedling and early vegetative stages (two or three sprays) delayed early disease incidence at Njoro but were not effective in reducing severity throughout the period of growth. This response is typical of susceptible chickpea varieties which are consistently susceptible from seedling to vegetative through flowering stages. Chongo and Gossen[10] reported that plant age did not affect disease progress in a susceptible chickpea variety UC27. Other studies by Trapero-Casas and Kaiser[7] also reported the same. In contrast, partially resistant varieties are highly resistant at seedling and vegetative stages but resistance declines as they approach flowering[9,21]. Results in this study indicate that five or six sprays at Egerton-Njoro and three or four sprays at Koibatek with azoxystrobin are needed for

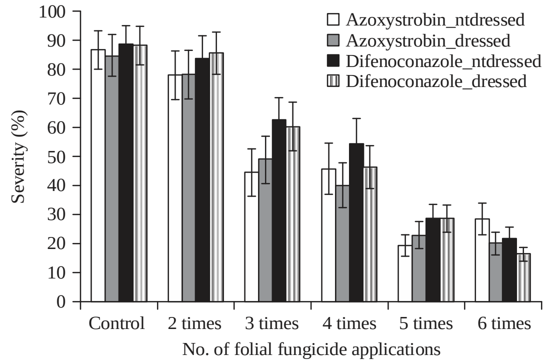

Fig. 1: Effect of fungicide spray schedule combined with seed treatment on disease severity index at Njoro in 2014

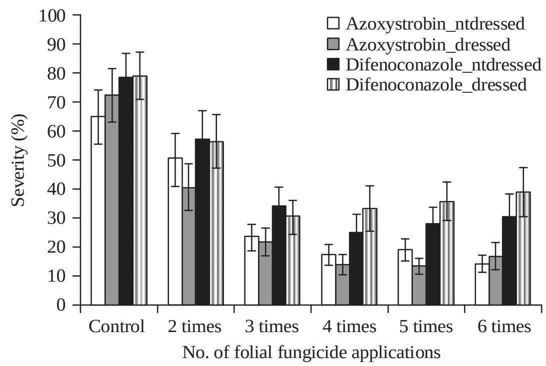

Fig. 2: Effect of fungicide spray schedule combined with seed treatment on disease severity index at Koibatek in 2014

effective control of ascochyta blight while six sprays at Egerton-Njoro and four sprays at Koibatek with difenoconazole are needed for effective control under high disease pressure on susceptible varieties (Table 2, 3). Difenoconazole may have better control of *A. rabiei in vitro*[5] but it appears to be slightly inferior in the field as compared to azoxystrobin. The strobilubin component has been found to have strong activity on *T. discolor*[22] in almonds and in brown spot (*Corynespora cassiicola*) and black spot (*Asperisporium caricae*) compared to triazole compounds that include difenoconazole[23].

Effect of azoxystrobin and difenoconazole seed treatment and foliar spray on disease severity: There were significant difference in disease severity between plots that were seed dressed followed with foliar sprays schedules and those that were only sprayed (Fig. 1, 2). This was the case even for the control (none sprayed) treatment. However, disease severity at the four times and five times spray schedules in Koibatek and six times schedule in Njoro were significantly lower where seed dressing was followed by foliar spray of azoxystrobin compared to none dressed treatments. Similar observations were made under six-spray schedule in Njoro and four-spray times schedule in Koibatek where difenoconazole was applied. The effect of combining seed treatment with foliar sprays did not show any advantage over the controls (absence of seed dressing) at later stages of growth (after seedling stage). The most important effect in reducing AB severity was that of foliar application of the fungicides evaluated in this study. Seed in this study were selected from a lot that were visually symptomless. The objective of seed dressing is to protect seedling from seed borne ascochyta. Seed dressing may not protect emerging seedlings from rain-drop splashed or wind borne inocula[24]. Selection of large sized seeds of chickpea, which are symptomless or conducting preliminary seed health tests should be carried out before planting chickpea especially in seed multiplication/breeding programs so as the appropriate fungicide may be applied.

CONCLUSION

This study concludes that AB incidence and severity in ICCV 97105 and similarly susceptible varieties of similar increases progressively from seedling to maturity. A successful control strategy should therefore target to prevent introduction of AB in the field or control disease immediately after infection regardless of the growth stage of the crop. Seed dressing as a control strategy with either of the two fungicides used did not prove to provide sufficient control in managing AB in the absence of foliar sprays. Additionally, using fungicides to dress clean seeds (visually asymptomatic) and following the treatment with foliar sprays may not be economical since foliar sprays were as effective when used alone. Azoxystrobin applied 4-5 times and difenoconazole applied five to six times between seedling and podding stages of chickpea growth are needed for effective control of AB in Egerton, Njoro and Koibatek, Baringo.

SIGNIFICANT STATEMENTS

Chickpea is an important drought tolerant legume with potential to do well in the ASALs regions and the cool dry highlands of Kenya during the short rains season. It has potential to improve nutrition by providing inexpensive quality proteins, improve soil health, break disease cycle in cereal cropping systems and provide livestock feed therefore enhancing food security. However, the crop is relatively new in these areas and its full adoption and productivity have not been realized due to high yield losses caused by ascochyta blight (AB) which can cause upto 100% yield loss. In the dry cool highlands where chickpea is grown as rotational crop during the short rains, the environmental conditions may change to wet, rainy (high RH>80%) and low temperatures (15-20°C). This favours the development of the pathogen causing total yield losses to farmers frequently. Since AB is spread through infected seed, the intensity of AB infestation could be reduced by maintaining high levels of seed health which involve use of clean seed. Most farmers however plant own-seed which in most cases is infected by AB serving as source of inocula that spreads from one farmer to another over several seasons. Although the most viable and economical control measure against AB is use of host plant resistance, the current released varieties have low resistance to the pathogen that is easily broken by new pathotypes frequently emerging in these areas. Moreover, the pathogen survives for long period of time in infected debris in the fields due to sexual state (Teleomorph) which favour frequent multiplication and spread of the disease, thus making cultural control measures ineffective. This study evaluated the use of disease free seed, host resistance, seed treatment and foliar sprays are integrated approach strategies in management of ascochyta blight (*Ascochyta rabiei* L.) in chickpea.

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