Current Journal of Applied Science and Technology

39(8): 12-17, 2020; Article no.CJAST.56517
ISSN: 2457-1024
(Past name: British Journal of Applied Science & Technology, Past ISSN: 2231-0843, NLM ID: 101664541)

Management of Leaf Blight Disease Caused by *Alternaria polianthi* in Tuberose

M. R. Ravikumar[1], D. K. Harish[2], B. H. Kumara[3] and Amarendra Kumar[4*]

[1]College of Agriculture, Hanumanamatti, Ranebennure, Karnataka, India.
[2]All India Coordinated Research Project for Dryland Agriculture (AICRPDA), Regional Agricultural Research Station, Vijayapura, Karnataka, India.
[3]ICAR-KVK, Sirsi, Uttara Kannada, Karnataka, India.
[4]Department of Plant Pathology, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author MRR carried out the research work and wrote the protocol. Author DKH designed the study and supervise the work. Author BHK managed the literature searches and performed statistical analysis. Author AK managed the analysis and wrote the first draft of manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2020/v39i830587
Editor(s):
(1) Dr. Aydin Unay, University of Aydin Adnan Menderes, Turkey.
Reviewers:
(1) Marco dos Santos Teixeira Pinto, Universidade Federal do Tocantins, Brasil.
(2) Qi Cheng, Biotechnology Research Institute, Chinese Academy of Agricultural Sciences, China.
(3) Bhupen K. Baruah, Jagannath Barooah College, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/56517

Original Research Article

Received 24 February 2020
Accepted 30 April 2020
Published 02 May 2020

ABSTRACT

Tuberose is an ornamental crop which is growing under tropical and sub-tropical areas. Recently, the incidence of leaf blight disease caused by *Alternaria polianthi* a fungal disease of tuberose is considered as a severe problem causing growth reduction and yield loss triggered by high temperature and humidity. Hence an investigation was carried out in farmer fields at Tumnakatti, Ranebennurtq in Karnataka, to study the bio-efficacy of different fungicides against leaf blight of tuberose. There were six chemicals *viz*., Tebuconazole 250 EC @ 0.1%, Difenconazole – 25% EC @ 0.1%, Propinoconazole 25% EC @ 0.1%, Hexaconazole 2% SC @ 0.1%, Mancozeb75 WP @ 0.25%, Chlorothalonil 75 WP @ 0.2%, were evaluated in tuberose cultivar Prajwal during *kharif* 2016 and 2017. Among the different fungicides, four sprays taken with Tebuconazole @ 0.1% at 15 days interval starting from onset of disease proved to be the most effective treatment and resulted

**Corresponding author: E-mail: kumaramar05@gmail.com;*

in lowest percent disease index, PDI (10.80). Maximum yield and number of flower stalks per square meter area were recorded in Tebuconazole @ 0.1% (50.90). Tebuconazole @ 0.1% could be used for management of leaf blight and increase the yield of tuberose.

Keywords: Tuberose; leaf blight; Alternaria polianthi; disease; fungicides.

1. INTRODUCTION

Tuberose (*Polianthe stuberosa* L.) is one of the most popular bulbous ornamental of tropical and sub- tropical areas and has considerable importance in the world market and crop has got a very good export potentiality [1]. It is a native of Mexico and belongs to the family Amaryllidaceae. It is commercially cultivated for cut and loose flower trade and also for the extraction of its highly valued natural flower oil [2]. The flowers are a good source of essential oils that can be used for the preparation of various perfumes and cosmetics. It is commercially cultivated in many countries of the world like India, Hawaii, China, Brazil, Italy, Iran, UK, USA etc. In India, the commercial cultivation of tuberose is generally practiced in West Bengal, Karnataka, Maharashtra, Tamil Nadu, Haryana, Punjab, Gujarat, Rajasthan, Andhra Pradesh including Assam [1,3]. Tuberose is susceptible to many diseases caused by fungi, bacteria and nematodes. Among fungal diseases, stem rot or tuber rot or sclerotial wilt (*Sclerotium rolfsii* Sacc.), botrytis spot or blight (*Botrytis elliptica*) and leaf spot (*Alternaria polianthi*) were important. Among bacterial diseases, the important one is flower bud rot (*Erwinia* spp.). Among nematodes, root-knot nematode (*Meloidogyne* spp.), reniform nematode (*Rotylenchulus reniformis)* and in some areas, greasy streak disease caused by a foliar nematode (*Aphelenchoides besseyi* Christie.) was important [4,5]. This crop has been affected by various fungal and viral diseases which affect growth and cause loss in flower yield. Among them, leaf spot incited by *Alternaria polianthi* is an important fungal disease Mariappan et. al. [6] in tuberose. In India, leaf spot in tuberose incited by *A. polyanthi* was first reported from the locality of Coimbatore ([6] and in the succeeding period once again from the same state, Tamil Nadu, Muthukumar et. al., [7]. The incidence of the disease is also common in Assam in the both single and double-type tuberose plants due to prevalence of high rainfall and humid conditions. Four sprays with azoxystrobin (0.1%) at 15 days interval, starting on disease appearance proved to be the most effective and resulted in the lowest disease incidence (10.98 PDI) compared to control (34.39 PDI) Mazumder et al. [8]. The effectiveness of iprodione (25%) and carbendazim (25%) and difenconazole (0.1%) in reducing leaf spot of tuberose was reported earlier Sharma and Bhattacharjee, [9]. Therefore, an attempt was made to investigate the effect of different fungicides against the leaf spot disease of tube rose under field condition.

2. MATERIALS AND METHODS

The field experiment was conducted in randomized block design with seven treatments and three replications during *kharif* seasons (2016 and 2017) in the farmers field at Tumminakatti, Ranebennuretq, Karnataka state where the leaf spot disease naturally occurs every crop season. The soil texture was sandy loam to silty clay loam with pH 5.2, organic carbon content 0.65% , available N 350.6 kg/ha, available P 11.9 kg/ha and available K 207.5 kg/ha. Mean monthly temperature and relative humidity were in the range of 7.92-36.4˚ C, 64.1-87.9%, respectively with and total annual rainfall 600mm.The treatments were comprised of Tebuconazole 250 EC @ 0.1%, Difenconazole – 25% EC @ 0.1 %, Propinoconazole 25% EC @ 0.1%, Hexaconazole 2% SC @ 0.1%, Mancozeb75 WP @ 0.25%, Chlorothalonil 75 WP @ 0.2% and control. Tuberose bulbs cv. Prajwa I were planted during March in the plots of 1.8 m x 1.5 m at spacing 30 cm x 30 cm. The plants were sprayed with fungicides four times at an interval of seven days starting from the first appearance of the disease symptom, mostly at flower stalk initiation stage. Per cent disease intensity was recorded one week after the last spray. Six clumps from the center of each plot were considered to compute the per cent disease index (PDI) on the basis of 0- 4 scales Horsfall and Henbeger, [10]. Flower stalk (no. / m2), weight of the freshly harvested stalk (g) and the length of the flower stalk (cm) were also recorded. Economics of fungicide application was computed on the basis of economic returns from flower yield and cost of fungicidal treatments Hugar et. al. [11]. The data of per cent disease incidence were subjected to angular

Table 1. Effect of Management of leaf blight disease caused by *Alternaria polianthi* in tuberose

Sl no	Treatment	Concentration	Per cent Disease Incidence Before spray			Per cent Disease Incidence After spray			No of flower stalk/ m^2		
			2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
T1	Tebuconazole -250 EC	0.1 %	7.55 (15.95)	6.82 (15.14)	7.19 (15.55)	11.35 (19.69)	10.25 (18.67)	10.80 (19.18)	50.30 (45.17)	51.50 (45.85)	50.90 (45.51)
T2	Difenconazole 25% EC	0.1 %	7.38 (15.76)	6.55 (14.83)	6.97 (15.30)	13.15 (21.26)	11.60 (19.91)	12.38 (20.59)	42.50 (40.68)	45.80 (42.59)	44.15 (41.64)
T3	Propinoconazole - 25 % EC	0.1 %	7.50 (15.89)	6.88 (15.20)	7.19 (15.55)	12.20 (20.44)	11.25 (19.59)	11.73 (20.02)	43.40 (41.20)	47.40 (43.50)	45.40 (42.36)
T4	Hexaconazole - 2 % SC	0.1%	7.35 (15.73)	7.00 (15.34)	7.18 (15.54)	14.25 (22.18)	12.88 (21.03)	13.57 (21.61)	40.20 (39.34)	43.30 (41.14)	41.75 (40.25)
T5	Mancozeb- 75 WP	0.25%	7.60 (16.00)	7.25 (15.62)	7.43 (15.81)	22.50 (28.31)	20.65 (27.02)	21.58 (27.67)	38.20 (38.17)	40.50 (39.52)	39.35 (38.85)
T6	Chlorothalonil –75 WP	0.2%	7.48 (15.87)	7.33 (15.71)	7.41 (15.79)	19.53 (26.22)	18.50 (25.47)	19.02 (25.85)	42.50 (40.68)	41.80 (40.28)	42.15 (40.48)
T7	Control		7.55 (15.95)	7.40 (15.78)	7.48 (15.86)	38.25 (38.20)	34.30 (35.85)	36.28 (37.03)	23.50 (28.99)	26.50 (30.98)	25.00 (30.00)
	S.Em±		0.15	0.51	0.08	1.07	1.20	0.74	1.66	2.10	1.61
	C.D at 5%		0.48	1.57	0.24	3.35	3.72	2.28	5.12	6.41	4.97

Table 2. Effect of different fungicides on leaf blight of tuberose (mean results of 2016 and 2017)

S. No.	Treatment	Concentration	Wt. of flower stalk (g)			Length of flower stalk (cm)			Bulb/Plant		
			2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
1	Tebuconazole -250 EC	0.1 %	84.0	81.9	83.0	73.7	70.2	71.9	31.0	30.9	31.0
2	Difenconazole 25% EC	0.1 %	82.0	80.6	81.3	70.0	69.8	69.9	29.0	29.7	29.3
3	Propinoconazole - 25% EC	0.1 %	83.7	80.2	81.9	74.0	69.3	71.7	30.0	29.0	29.5
4	Hexaconazole - 2% SC	0.1%	78.3	78.0	78.2	67.0	64.6	65.8	28.0	27.7	27.8
5	Mancozeb- 75 WP	0.25%	81.0	77.5	79.3	69.3	64.2	66.8	27.0	27.4	27.2
6	Chlorothalonil –75 WP	0.2%	81.7	78.8	80.2	71.0	68.7	69.8	27.5	28.5	28.0
7	Control		71.7	71.8	71.7	63.0	61.1	62.0	22.5	22.0	22.3
	S.Em ±		1.04	0.33	0.480	0.63	0.88	0.526	0.85	0.51	0.396
	C.D. at 5%		3.26	1.09	1.494	1.97	2.75	1.640	2.50	1.57	1.234

Table 3. Comparative assessment over two years of different treatments on monetary returns of tuberose (2016 and 2017)

S. no.	Treatment	Concentration	Yield/ha.		Total monetary returns (Rs. Lakh/ha.)	Cost of production (Rs. Lakh/ha.)	Net profit (Rs. Lakh/ha.)	B:C ratio
			Fl. Stalk lakh /ha.	Bulb lakh/ha.				
1	Tebuconazole -250 EC	0.1 %	5.1	14.35	12.20	3.04	9.16	4.01
2	Difenconazole 25% EC	0.1 %	4.4	12.51	10.63	3.89	6.74	2.73
3	Propinoconazole - 25% EC	0.1 %	4.5	13.16	11.20	3.94	7.26	2.84
4	Hexaconazole - 2% SC	0.1%	4.1	11.70	9.95	3.82	6.13	2.60
5	Mancozeb- 75 WP	0.25%	3.9	10.87	9.24	3.85	5.34	2.40
6	Chlorothalonil –75 WP	0.2%	4.2	11.42	9.71	3.90	5.81	2.45
7	Control		2.5	6.74	5.73	5.00	0.73	1.15

transformation and analysis of variance was calculated out [12].

3. RESULTS AND DISCUSSION

Leaf spot was first observed during the flower stalk initiation stage and increased gradually with the advancement of crop growth. The result indicated that the fungicidal spray could manage the disease adequately. Spraying of fungicides, starting the first spray at the appearance of disease symptom was effective in reducing leaf spot of tuberose significantly. The percent disease incidence was revealed not significant among all the treatments before the spary of chemicals including check while the treatments showed significant difference among the treatments after the spray (Table 1). The percent disease incidence after spray showed minimum in treatment tebuconazole 250 EC @ 0.1% (10.80) which was at par with propinoconazole 25% EC @ 0.1% (11.73) and significantly superior among all the treatments. The maximum disease incidence after spray was found in check (36.28) (Table 1). No of flower stalk/ m2 was found maximum in treatment tebuconazole 250 EC @ 0.1% (50.90) followed by propinoconazole 25% EC @ 0.1% (45.40). The maximum wt. of flower stalk (g) was reported in treatment tebuconazole 250 EC @ 0.1% (83.0) followed by propinoconazole 25% EC @ 0.1% (81.9) (Table 2). The maximum length of flower stalk (cm) was revealed in treatment tebuconazole 250 EC @ 0.1% (71.9) which was at par with propinoconazole 25% EC @ 0.1% (71.7) and significantly superior among all the treatments. The minimum length of flower stalk (cm) was revealed in control (62.0). The maximum and minimum bulb/plant were found in treatment tebuconazole 250 EC @ 0.1% and control *i.e.*31.0 and 22.3 respectively (Table 2). The flower stalk lakh /ha and Bulb lakh/ha were found maximum in treatment tebuconazole 250 EC @ 0.1% i.e. 5.1 and 14.35 respectively.

Although, disease control as high as 70.23% was achieved in tebuconazole (0.1%), but it proved to be costlier as compared to the other treatments (Table 1). However, it recorded third highest benefit cost ratio (4.01). Maximum flower stalk production (50.90/ m2) and their individual fresh weight (78.00 g) were obtained in the plots treated with tebuconazole(0.1%) as compared to 25/ m2 and 55.00 g in case of control and showed 143.75% increase in flower stalk yield over control. The effectiveness of tebuconazole (0.1%) against tuberose leaf spot had also been reported Anon. [13]. The maximum yield of flower stalks and bulbs (Table 2) were obtained in with tebuconazole0.1% (5.1 lakh flower stalks/ha. and 14.35 lakh bulb/ha.), propinoconazole 0.1% (4.5lakh flower stalks/ha. and 13.16 lakh bulbs/ha.) and difenoconazole 0.1% (4.4 lakh flower stalks/ha. and 12.51 bulbs/ha.)

The data presented in Table 3 revealed that different treatments gave monetary returns ranging from Rs. 12.20 lakh/ha. to 9.24 lakh/ha. as against Rs. 5.73 lakh/ha. in control. The highest monetary returns of Rs. 12.20 lakh/ha. with maximum benefit cost ratio 4.01 was obtained in sprays with tebuconazole 0.1%. The other effective fungicides i.e. Hexaconazole 0.1%, Mancozeb 0.25% and chlorothalonil 0.2% fails to give good benefit cost ratio due to higher cost of fungicides**.** Similar results were recorded by Dubey et al. [14] Anonymous, [15] Rao [16] and Robak [17].

4. CONCLUSION

Four sprays with Tebuconazole (0.1%) at 15 days interval, starting on disease appearance proved to be the most effective and resulted in the lowest disease incidence (10.80 PDI) compared to control(36.28 PDI). This treatment also gave a fairly good benefit: cost (B: C) ratio of 6.87. The economic analysis, however, revealed the effectiveness of a fungicide, Tebuconazole (25%), followed by Propinoconazole when they were applied at 0.1% concentration. These treatments recorded highest B:C ratio of 4.01 and 2.84 with 69.98% and 71.47% disease reduction, respectively.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Biswas B, Naveen Kumar P, Bhattacharjee SK. In: Tuberose, AICRP on Floriculture, Tech Bull No. 2002;21:iii.
2. Mishra A, Tiwary AK, Sharma JP. Effect of bio-control agent and chemicals on root rot and yield attributes in tuberose (*Polianthes tubarosa* Linn.) cultivars Calcutta Double. J. Ornamental Hort. 2008;11:41-44.
3. Khan MR, Pal AK. Plant parasitic nematode associated with Tuberose (*Polianthes tuberosa* L.) in West Bengal. Ann. Pl. Prot. Sci. 2001;9:304-306.

4. Singh PC, Singh D. *In vitro* evaluation of fungicides against *Alternaria alternata*. Ann. Pl. Protec. Sci. 2006;14:500-502.
5. Singh AK, Flower crops cultivation and management. New India publishing agency, pitampura, New Delhi-110 088. 2006;658.
6. Mariappan V, Babu K, Kandasamy TK. A leaf spot disease of tuberose (*Polianthes tuberose* L.) caused by new species of *Alternaria*. Curr. Sci. 1977;46:311.
7. Muthukumar A, Bhaskaran R, Eswaran A, Kumar M Raj. Studies on biochemical properties of healthy and leaf spot infected tuberose plants. Indian J. Hort. 2007; 46:190-193.
8. Mazumder N, Borah SK, Hatibarua P. Management of leaf spot (*Alternaria polianthi*) of tuberose through fungicides. Agric. Sci. Digest. 2016;36(3):250-252.
9. Sharma P, Bhattacharjee SK. Plant protection in ornamental crops. AICRP on Floriculture, ICAR, New Delhi-12, Technical Bulletin No.19. 2002;64.
10. Horsfall JG, Henberger JW. Measuring magnitude of a defoliation diseases of tomato. *Phytopathology*. 1942;32:226-232.
11. Hugar SV, Hosamoni Venkatesh Pradeep S, Hanumanthaswamy BC. Evaluation of new chemical molecules for the management of *Scirpophagus incertulus* Walker, in aerobic rice. International Journal of Plant Protection. 2009;2:205-208
12. Snedecor WG, Cochran WG. Statistical Methods. The Iowa State University Press, Ames, Iowa. 1967;593.
13. Anonymous. Progress Report, AICRP (Floriculture), Directorate of Floricultural Research, ICAR, New Delhi- 12. 2004; 05:xiii.
14. Dubey SC, Patil B, Jha DK. Chemical management of Alternaria blight of broad bean. Indian Phyto Path. 2000;53(2):211-214
15. Anonymous. Progress Report, AICRP (Floriculture), Directorate of Floricultural Research, ICAR, New Delhi-12. 2012; 2011-12:xii.
16. Rao MSL, Studies on seed borne fungal diseases of sunflower and their management. *Ph.D. Thesis,* Univ. Agric. Sci., Dharwad, India; 2006.
17. Robak J. Recent advance at integrated protection of cabbages against diseases with attention to club root (*Plasmodiophora brassicae)*, Alternaria leaf spot (*Alternaria* spp.) and grey mold (*Botrytis cinerea*). Progress-in-Plant-Protection. 1998;38:119-123.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/56517