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Current scenario of turicum leaf blight of maize in northern parts of Karnataka

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Abstract

Survey was conducted for two consecutive years of *kharif* 2019 and 2020 in northern Karnataka to determine the severity of turicum leaf blight of maize and pesticides usage by the farmer for the management of turicum leaf blight. TLB is widely distributed in northern Karnataka in moderate to severe form. Five districts namely Belagavi, Dharwad, Haveri, Davangere and Uttar Kannada have recorded more than 40 per cent disease severity. The irrigated condition, black soil and dough stage of crop influences the disease severity. Few farmers used (Azoxystrobin 18.2% + Difenoconazole 11.4% SC) and emamectin benzoate 5 SG for the management of turicum leaf blight and fall armyworm respectively.

Keywords: Maize, *Exserohilum turcicum* leaf blight, pesticides

Introduction

Maize (*Zea mays* L.) is one of the most versatile crop having wider adaptability under varied agro-ecological and climatic conditions. Globally, maize is known as “Queen of Cereals” as it is grown throughout the year due to its photo-thermo insensitive character and highest genetic yield potential among the cereals. In India, Maize is cultivated throughout the year in most of the states for various purposes including grain, feed, fodder, green cobs, babycorn, sweet corn, popcorn and industrial products. In addition to staple food for human being and quality feed for animals, maize serves as a basic raw material as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, package and paper industries *etc.* Maize is prone to as many as 112 diseases in different parts of the world, caused by fungi, bacteria, viruses and nematodes leading to extensive damage. In India about sixty one diseases have been reported to affect the crop. These include seedling blights, foliar diseases, stalk rots, downy mildews and ear rots (Payak and Sharma, 1985) [9]. Among several diseases, turicum leaf blight is one of the ubiquitous foliar disease of maize. It is caused by *Exserohilum turcicum* (Pass.) Leonard and Suggs. (Synonyms: *Drechslera turcica* (Pass.) Subramanian and Jain; *Bipolaris turcica* (Pass.) Shoemaker; *Helminthosporium turcicum* (Pass.) Leonard and Suggs. The teleomorph stage of the pathogen is *Setosphaeria turcica* (Luttrell) Leonard and Suggs. [Synonym: *Trichometasphaeria turcica* (Luttrell)]. The disease was first described as early as 1876 by Passerine from Italy and by Butler (1918) [1] from India. The loss in grain yield up to an extent of 46.7 per cent has been reported due to this disease in maize (Pandurang Gowda *et al.*, 1993) [8]. In Karnataka, turicum leaf blight is an important fungal foliar disease affecting several cultivated hybrids and composites. The disease is prevalent in almost all the maize growing areas of the state. Among the diseases adversely affecting productivity, the ubiquitous incidence of turicum leaf blight in the pre-harvest stage is prominent. The disease is responsible for the premature death of blighted leaves and results in significant yield reductions. It is considered to be one of the most devastating diseases as it appears in sizeable form in Karnataka resulting in a reduction of grain yield of maize by 28 to 91 per cent (Harlapur *et al.*, 2009) [3]. The disease is known to effect maize from seedling stage to harvest. Loss in grain yield will be more if it occurs at flowering, silking and grain filling stages due to decreased photosynthetic area. In present investigation, survey was undertaken to know the present status of turicum leaf blight of maize disease severity in major maize growing areas in northern parts of Karnataka.

Materials and Methods

Roving survey was conducted to know the maize turcicum leaf blight disease severity and knowledge on pesticides usage by farmer for the management of turcicum leaf blight (TLB) and fall armyworm (FAW) in maize crop in the major maize growing areas in northern parts of Karnataka *viz.*, Bagalkot, Belagavi, Davangere, Dharwad, Gadag, Haveri and Uttar Kannada districts during *kharif* 2019 and 2020. Survey was conducted at flowering to dough stage of crop. A total of 280 fields from 70 villages belonging to 21 taluks comprised of seven different districts were surveyed and in each village,

five fields were selected and in each field fifteen plants were randomly examined. Meanwhile, the information of soil type, tank mix, spray intervals and pesticides used by the farmers in respective areas were collected. Observations on severity of the disease were recorded by applying modified 1-9 disease rating scale (Anon, 2018) [5]. Further the per cent disease index (PDI) was calculated by using the formula given by Wheeler, 1969 [12].

$$PDI = \frac{\text{Sum of all disease ratings}}{\text{Total number of plants observed}} \times \frac{100}{\text{Maximum disease grade}}$$

Modified disease rating scale for TLB (1-9)

Rating scale	Degree of infection
1	Nil to very slight infection ($\leq 10\%$)
2	Slight infection, a few lesions scattered on two lower leaves (10.1-20%)
3	Light infection, moderate number of lesions scattered on four lower leaves (20.1-30%)
4	Light infection, moderate number of lesions scattered on lower leaves, a few lesion scattered on middle leaves below the cob (30.1-40%)
5	Moderate infection, abundant number of lesions scattered on lower leaves, moderate number of lesions scattered on middle leaves below the cob (40.1-50%)
6	Heavy infection, abundant number of lesions scattered on lower leaves, moderate infection on middle leaves and a few lesions on two leaves above the cob (50.1-60%)
7	Heavy infection, abundant number of lesions scattered on lower and middle leaves and moderate number of lesions on two to four leaves above the cob (60.1-70%)
8	Very heavy infection, lesions abundant scattered on lower and middle leaves and spreading up to the flag leaf (70.1-80%)
9	Very heavy infection, lesions abundant scattered on almost all the leaves, plant prematurely dried and killed ($>80\%$)

Results and Discussion

The disease severity varied from one locality to another due to weather factors majorly temperature and relative humidity, cropping pattern, variety used, type of soil, cultivar grown condition and timely adoption of plant protection management measures. The observations on severity of turcicum leaf blight and pesticides used by the farmers were recorded and presented in the Table 1. The data revealed that, the severity of the disease in all the surveyed areas which ranged from 31.48 to 53.75 per cent. Among the villages surveyed Gokak village of Gokak taluk of Belagavi district recorded the maximum percent disease index (PDI) of 53.75 and simikeri village of Bagalkot district recorded the minimum PDI of 31.48 per cent.

Among the different taluks surveyed, the per cent disease index ranged from 34.01 to 51.76. The highest per cent disease index (51.76 %) was noticed from Gokak taluk followed by Hukkeri taluk (50.70%) of Belagavi district and the least PDI was recorded in Gadag (34.01 %) taluk of Gadag district followed by Bagalkot of Bagalkot district (34.51). Ron taluk of Gadag district and Sirsi taluk of Uttar Kannada district recorded the same per cent disease index of 37.38 (Fig 1). Among the seven districts surveyed the mean maximum severity was observed in Belagavi district (49.42 %) followed by Haveri district (45.95 %) whereas severity of the disease was observed to be less (36.50 %) in Gadag district (Fig 2). The highest disease severity was recorded in black soil. While, the severity in red soil was found to be least. However, the disease severity was found higher in case of irrigated condition when compared to rainfed.

The farmers used several fungicides and insecticides for the management of turcicum leaf blight and fall armyworm respectively in maize crop. The major fungicides were used [Azoxytrobilin 18.2% + Difenoconazole 11.4% SC], Mancozeb 75% WP and Hexaconazole 5% SC and major

insecticides used *viz.*, Emamectin benzoate 5% SG, Spinetoram 120 SC and [Novaluron 5.25% + Emamectin benzoate 0.9% SC]. The farmers followed the fifteen days spray interval for the application of fungicides or insecticides. TLB widely distributed in northern Karnataka. Other maize diseases *viz.*, common rust, curvularia leaf spot and maydis leaf blight recorded in traces in all the surveyed areas. Phaeosporaria leaf spot of maize disease was noticed in Belagavi, Haveri and some villages of Dharwad districts. Banded leaf and sheath blight of maize was observed in Gadag, Uttar Kannada and some taluks of Haveri districts. The results also revealed that, the maximum disease severity of TLB was observed in many characteristics such as irrigated areas, black soil and dough stage of crop. This might be owing to lower temperatures and higher relative humidity, creating a microclimate conducive to disease progression under irrigated conditions. Diseases were more prevalent in black soil than in red soil, which could be due to the fact that black soil has a larger water holding capacity than red soil, which aids in the creation of a conducive microclimate in black soil.

The present findings are in accordance with Harlapur (2005) [2] and Khedekar *et al.* (2010) [6] who stated that, prevailing environmental conditions during cropping season could be a reason for higher severity of disease in these areas. According to Ullstrup (1966) [11], TLB incidence and severity varied from year to year as well as one location to another depending on prevalence of environmental conditions. Harlapur *et al.* (2000) [4] reported that, cultivar susceptibility and favourable weather parameters play an important role for the high severity of the disease. Similar observations were also made by Manu *et al.* (2018) [7] and Poornima and Kalappanavar (2017) [10].

Table 1: Survey on severity of turicum leaf blight of maize and farmers practices on pesticide usage in northern parts of Karnataka (Pooled kharif 2019 and 2020)

District	Taluk	Village	Soil type	Cultivation	Stage of crop	Major insect pests	Pesticide	Spray interval (days)	Other diseases observed	PDI	
Bagalkot	Bagalkot	Bagalkot	Black	Irrigated	Grain filling	FAW	S, AD, EB	15	CLS, CR, MLB	35.97	
		Kaladagi	Red	Irrigated	Grain filling	FAW	H and EB	8	CLS, MLB	36.08	
		Simikeri	Black	Irrigated	Silking	FAW	C, H, and EB	15	CLS, MLB	31.48	
	Taluk mean										34.51
	Jamakhandi	Jamakhandi	Black	Rainfed	Dough	FAW	M and EB	15	CLS, MLB	43.57	
		Kakanwadi	Black	Irrigated	Grain filling	FAW	M and EB	7	CLS, MLB	42.32	
		Savalagi	Black	Rainfed	Grain filling	FAW	C, M and EB	15	CLS, MLB	44.94	
	Taluk mean										43.61
	Mudhol	Lokapur	Black	Irrigated	Dough	FAW	M and EB	15	MLB, CLS, CR	39.42	
		Mudhol	Black	Irrigated	Grain filling	FAW	AD and EB	8	MLB, CLS, CR	40.61	
		Soraganva	Red	Irrigated	Grain filling	FAW	EB and M	8	MLB, CLS, CR	40.30	
	Taluk mean										40.11
	District mean										39.41
Belagavi	Bailhongal	Bailhongal	Black	Rainfed	Grain filling	FAW	AD and EB	15	CLS, MLB, PLS	46.86	
		Belavadi	Black	Rainfed	Dough	FAW	Cp, AD and EB	15 & 10	CLS, CR, PLS	43.72	
		Sangolli	Black	Rainfed	Grain filling	FAW	M, EB	8	MLB, CLS, CR	46.77	
	Taluk mean										45.78
District	Taluk	Village	Soil type	Cultivation	Stage of crop	Major insect pests	Pesticide	Spray interval (days)	Other diseases observed	PDI	
Belagavi	Gokak	Arabhavi	Black	Irrigated	Dough	FAW	Cp, M, EB	15	CLS, CR, PLS	53.315	
		Gokak	Black	Irrigated	Dough	FAW	Cp, M, EB	8	MLB, CLS, CR, PLS	53.75	
		Kolavi	Black	Irrigated	Grain filling	FAW	AD and EB	15	MLB, CLS, PLS	48.22	
	Taluk mean										51.76
	Hukkeri	Daddi	Black	Rainfed	Dough	FAW	AD and EB	7	BSR, MLB, CLS	47.40	
		Hukkeri	Black	Irrigated	Grain filling	FAW	AD and EB, S	15 & 10	MLB, CLS, PLS	53.61	
		Kotabagi	Black	Irrigated	Dough	FAW	AD and EB	15	MLB, CLS	51.11	
	Taluk mean										50.70
	District mean										49.42
	Dharwad	Dharwad	Garag	Black	Rainfed	Grain filling	FAW	AD and EB	15	MLB, CLS, PLS	44.60
Mugad			Black	Irrigated	Dough	FAW	AD, EB and S	8	BSR, MLB, CLS, CR	44.38	
Narendra			Black	Rainfed	Silking	FAW	Cp, AD and EB	15 & 10	MLB, CLS, CR, PLS	44.32	
Taluk mean										44.43	
Kalaghatagi		Dummawada	Black	Rainfed	Dough	FAW	AD and EB	15	CLS, CR, PLS	40.04	
		Jinnur	Red	Rainfed	Grain filling	FAW	Cp, H and EB	7	CLS, CR, PLS	40.38	
		Tabakadahonnalli	Black	Rainfed	Dough	FAW	H and EB	8	CLS, CR, PLS	39.32	
Taluk mean										39.91	
Navalgund		Belavatagi	Black	Rainfed	Dough	FAW	H and EB	15	CLS, PLS	43.89	
		Kiresur	Black	Irrigated	Dough	FAW	A, M, EB and S	15	BSR, CLS, MLB	44.25	
District	Taluk	Village	Soil type	Cultivation	Stage of crop	Major insect pests	Pesticide	Spray interval (days)	Other diseases observed	PDI	
Dharwad	Navalgund	Navalgund	Black	Rainfed	Grain filling	FAW	M and EB	15	CLS, FSR, PLS	42.71	
		Yamanur	Black	Rainfed	Dough	FAW	A, M and EB	15	MLB, CLS, CR	45.94	
	Taluk mean										44.19
District mean										42.85	
Davangere	Davangere	Anagodu	Red	Rainfed	Dough	FAW	AD, EB and NEB	15	CLS	45.64	
		Doddabatti	Red	Rainfed	Dough	FAW and SB	AD, EB and P	15 & 10	CLS, CR	45.17	
		Honnur	Red	Rainfed	Grain filling	FAW	AD, EB and NEB	7	CSL	48.72	
	Taluk mean										46.51
	Harihar	Belludi	Black	Irrigated	Dough	FAW	AD, EB and NEB	15	BSR, CLS	47.59	
		Bhanuvalli	Red	Rainfed	Dough	FAW and SB	AD, EB and P	7 & 10	CLS, CR	48.90	
		Sherapura	Black	Rainfed	Grain filling	FAW	M, EB and NEB	7	CLS, CR	41.38	
	Taluk mean										45.95
	Jagaluru	Devikere	Black	Rainfed	Dough	FAW and SB	M, EB and C	15	CLS, CR	45.62	
		Jagaluru	Black	Rainfed	Grain filling	FAW	M, EB and C	8	CLS, CR	42.73	
Jammapura		Red	Irrigated	Dough	FAW	AD and EB	15	BSR, CSL	44.39		
Taluk mean										44.24	
District mean										45.57	

Gadag	Gadag	Gadag	Black	Rainfed	Silking	FAW and SB	A, AD and EB	15	CLS, MLB	37.48	
		Hirehandigola	Red	Rainfed	Grain filling	FAW	A, AD and EB	7	BSR, CLS, MLB	33.34	
District	Taluk	Village	Soil type	Cultivation	Stage of crop	Major insect pests	Pesticide	Spray interval (days)	Other diseases observed	PDI	
Gadag		Hirekoppa	Black	Rainfed	Grain filling	FAW	M, EB and NEB	7	CLS, CR, MLB	32.59	
		Hulkoti	Black	Irrigated	Dough	FAW	M and EB	15	BSLB, CLS, CR, MLB	32.64	
		Taluk mean									34.01
	Naragund	Konnur	Black	Rainfed	Dough	FAW	AD and EB	15	BSR, CLS, CR, MLB	33.76	
		Kurlageri	Black	Irrigated	Dough	FAW and SB	AD, EB, and NEB	8 & 10	BSLB, CLS, CR, MLB	41.34	
		Naragund	Black	Rainfed	Dough	FAW	M and EB	15	CLS, CR, MLB	39.23	
	Taluk mean									38.11	
	Ron	Abbigeri	Black	Rainfed	Dough	FAW	M, EB and NEB	8	CLS, CR, MLB	42.92	
		Kotabal	Black	Rainfed	Dough	FAW	AD and EB	15	CLS, CR, MLB	36.94	
		Mallapur	Black	Irrigated	Dough	FAW	AD and EB	15	CLS, CR, MLB	34.88	
		Rona	Black	Rainfed	Grain filling	FAW	A, M and EB	8	BSR, CLS, CR	34.78	
	Taluk mean									37.38	
	District mean									36.50	
	Haveri	Haveri	Devgiri	Black	Rainfed	Dough	FAW	A, AD, EB and P	15	CLS, MLB	46.64
			Haveri	Black	Irrigated	Dough	FAW and SB	AD, EB and P	8 & 10	BSLB, CLS, CR, PLS	49.34
Kanakpur			Black	Irrigated	Dough	FAW	AD and EB	15	CLS, CR, PLS	47.82	
Karjagi			Red	Rainfed	Grain filling	FAW and SB	H, EB and Cp	7	CLS, CR, PLS	48.40	
Taluk mean									48.05		
Hirekerur	Battikoppa	Black	Irrigated	Dough	FAW	AD, EB and Cp	15	CLS, CR, MLB	42.67		
District	Taluk	Village	Soil type	Cultivation	Stage of crop	Major insect pests	Pesticide	Spray interval (days)	Other diseases observed	PDI	
Haveri		Dudihalli	Red	Rainfed	Dough	FAW	H and EB	15	BSLB, CLS, CR, PLS	45.22	
		Hirekerura	Black	Rainfed	Grain filling	FAW	AD, EB and Cp	8	CLS, CR, MLB, PLS	41.75	
		Masur	Black	Rainfed	Dough	FAW	AD and EB	15	CLS, CR, MLB	44.39	
	Taluk mean									43.51	
	Ranebennur	Chalageri	Black	Irrigated	Dough	FAW	AD, EB, Cp and P	15 & 10	CLS, CR,	46.60	
		Hulihalli	Black	Rainfed	Grain filling	FAW and SB	AD and EB	8 & 10	CLS, CR, MLB	47.69	
		Kamadoda	Black	Rainfed	Dough	FAW	AD and EB	15	BLSB, CR, MLB, PLS	42.09	
		Ranebennura	Black	Rainfed	Silking	FAW	H, EB and P	8	CLS, CR, MLB	48.85	
	Taluk mean									46.31	
	District mean									45.95	
Uttar Kannada	Haliyal	Jogankoppa	Black	Rainfed	Dough	FAW	M and EB	15	CLS, CR	41.10	
		Mavinkoppa	Red	Rainfed	Dough	FAW	M, EB and S	10	BSLB, CLS, CR	41.51	
		Murkawada	Red	Irrigated	Grain filling	FAW	H and EB	15	CLS, CR	39.08	
	Taluk mean									40.56	
	Mundgod	Kavalkoppa	Red	Rainfed	Dough	FAW	A, M and EB	15	BSLB, CLS, CR	46.87	
		Koppa	Red	Irrigated	Dough	FAW	M and EB	8	CLS, CR	44.44	
		Mundgod	Red	Irrigated	Dough	FAW	A, M and EB	15	BSLB, CLS, CR	42.80	
		Pala	Red	Rainfed	Grain filling	FAW	H and EB	7	BSLB, CLS, CR	42.55	
	Taluk mean									44.17	
	Sirsi	Bisalkoppa	Red	Rainfed	Silking	FAW	A, M and EB	15	CLS, CR	34.45	
District	Taluk	Village	Soil type	Cultivation	Stage of crop	Major insect pests	Pesticide	Spray interval (days)	Other diseases observed	PDI	
Uttar Kannada	Sirsi	Dasangadde	Red	Rainfed	Silking	FAW	H and EB	7	BSLB, CLS, CR	41.63	
		Halerikoppa	Red	Rainfed	Grain filling	FAW	M and EB	15	CLS, CR	36.07	
	Taluk mean									37.38	
District mean									40.70		

A: Azadirachtin 0.03%; AD: (Azoxystrobin 18.2% + Difenconazole 11.4% SC); BSLB: Bandend sheath and leaf blight; BSR: Brown stem rot; BOKS Battery operated Knapsack sprayer; C: Chlorpyrifos 20% EC; CLS: Curvularia leaf spot; CR: Common rust; Cp: Chlorantraniliprole 18.5% SC; Cy: Cypermethrin 10% EC; EB: Emamectin benzoate 5% SG; F: Flubendiamide 480SC; FAW: Fall army worm; H: Hexaconazole 5% SC; KS: Knapsack sprayer; M: Mancozeb 75% WP; MLB: Maydis leaf blight; NEB: (Novaluron 5.25% + Emamectin benzoate 0.9% SC); P: Profenophos 50% EC; PLS: Phaeosphaeria leaf spot S: Spinetoram 120 SC; SB: Stem borer

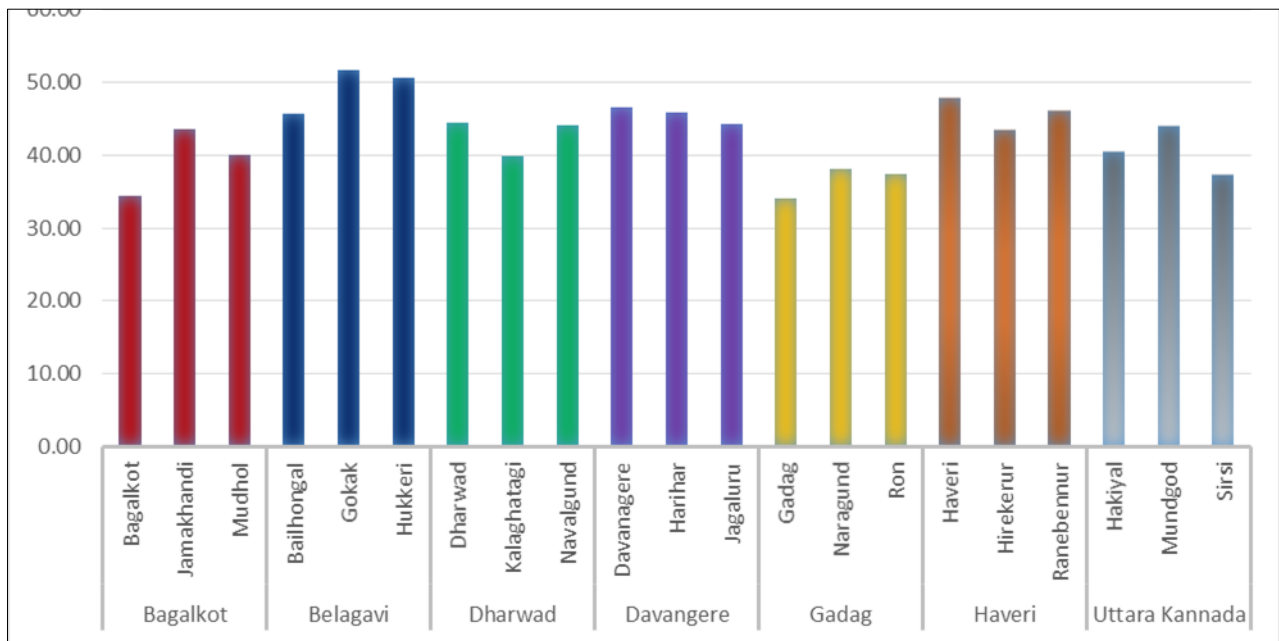


Fig 1: Mean per cent disease index of taluks surveyed during *Kharif* 2019 and 2020

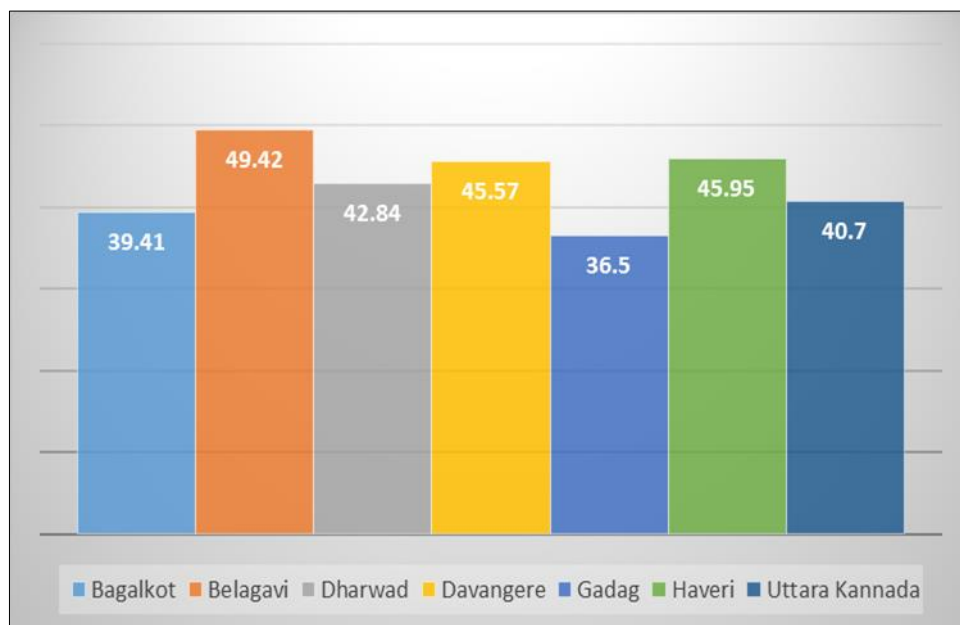


Fig 2: Mean per cent disease index of districts surveyed during *Kharif* 2019 and 2020

Conclusion

From the present findings, it is concluded that, moderate to high severity of turcicum leaf blight of maize noticed in all the maize growing areas. Belagavi and Haveri districts were identified as hotspots. High disease severity may be attributed to the continuous monoculture of maize and favourable environmental conditions. Hence, farmers need to cultivate resistant commercial hybrids and need to take up prophylactic spray applications with effective pesticides to prevent economic losses.

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