

Original Research Article

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Effect of Tillage and Nutrient Management Practices on Maydis Leaf Blight of Maize

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ABSTRACT

Keywords

A Maydis leaf blight, Tillage management, Nutrient management, Integrated management

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Maydis leaf blight caused by *Biopolaris maydis* is highly destructive diseases of maize crop worldwide including India. Depending upon weather conditions they cause the significant yield reduction ranging from 28 to 91 % in maize crop. Hot and humid conditions preferred by Maydis leaf blight. It is present in all tropical and temperate maize growing regions. Growing conditions creating hot and humid condition are most advantageous for the development of the disease. Under tarai condition of Uttarakhand an experiment was carried out by integrating tillage practices like - permanent raised beds, zero tillage and conventional tillage along with different nutrient management approaches like- RDF, SSNF and Farmer's practices for the management of maize diseases. Results of present study indicated that conventional tillage followed by permanent raised bed and zero tillage and in nutrient management SSNM followed by RDF management practices were found equally good with respect to disease severity but significantly higher grain yield was recorded in permanent raised beds (5817 Kg/ha) and in conventional tillage (5748 Kg/ha) which was found at par with permanent raised beds whereas minimum yield was recorded in zero tillage (5617 Kg/ha). But significantly higher thousand grain weight was recorded in conventional tillage (306 g) and permanent beds (305 g) which was at par, followed by zero tillage (282 g).

Introduction

Where ever maize is grown Maydis leaf blight (MLB) disease is almost present. It is also known as Southern corn leaf blight (SCLB) and caused by fungus *Bipolaris maydis* (Y. Nisik. & C. Miyake) Shoemaker, (Teleomorph: *Cochliobolus heterostrophus* (Drechsler) Drechsler. Under hot and humid, tropical and temperate climates of the world

the disease is highly destructive. First time from United States Drechsler reported the fungus *Helminthosporium maydis* in 1925. Munjal and Kapoor (1960) was first time reported *H. maydis* from Maldah district in West Bengal, (India), The outbreak of *Helminthosporium maydis* from Ludhiana and Rajasthan reported by Sharma *et al.*, (1978). In Andhra Pradesh, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu &

Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Punjab, Rajasthan, Sikkim, Tamil Nadu Uttarakhand and Uttar Pradesh states of India now *Helminthosporium maydis* has become a serious problem. Under different weather conditions Maydis Leaf Blight causes yield reduction ranging from 28 to 91 % in maize crop (Bera and Giri, 1979; Harlapur *et al.*, 2000; Sharma *et al.*, 2003; Sharma and Sharma, 2006; Sharma and Singh 2019; Kumar and Saxena, 2007). Wang *et al.*, (2001) and Ali *et al.*, (2011) have reported yield loss up to the extent of 70 percent Due to this disease. Sumner and Littrell (1974) reported that survival and spread of disease depends upon amount of rainfall, relative humidity and temperature of the area. Schenck and Stelter (1974) reported that long and sunny growing seasons with dry conditions are highly unfavorable for disease development. High humidity level and a warm temperatures range between 20⁰C to 32⁰C are particularly conducive to MLB (Anonymous, 1997). Ullstrup (1972) reported that pathogen can not survive in debris buried at 5-20 cm but it can survive in infected maize debris on the soil surface or in seed. The MLB pathogen found on seed and it spreads on seedlings from infected seeds (Boothryod, 1971; Kulik, 1971; Singh *et al.*, 1974). Under *in vitro* condition nearly 28⁰C is Optimum temperature for growth and conidial germination. The temperature range of 20-28⁰C is needed for conidial sporulation under continuous light and 28⁰C in total dark for race O, while for race T it is 20⁰C and 24⁰C, respectively (Aylor, 1975).

Cultivation practices favoring high humidity and moderate temperature conditions may influence the development of maydis blight. Keeping in view the importance of this disease in the region an integrated strategy involving tillage practices and nutrient management practices like Recommended

Dose of fertilizers, Site Specific Nutrient Management and Farmer's practices were evaluated for devising an integrated approach for the management of Maydis leaf blight of maize under *tarai* conditions of Uttarakhand.

Materials and Methods

Field experiment was conducted during *kharif* 2017 and 2018 in Maize Agronomy block at Norman E. Borlaug Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand. It has sub tropical climate with hot and humid summer and cold winters. Field experiments were conducted using hybrid DH 296 to develop the integration of tillage and nutrient management practice for the management of maydis leaf blight of maize. Plot size was 3.0 meter x 4.00 m² with three replication of each treatment. Trail was laid out in split plot design with three types of tillage practices viz, Permanent Raised Beds (PRB), Zero tillage (ZT) and Conventional tillage (CT) as in main plot and three sub plot viz, Recommended Dose of fertilizers (RDF), Site Specific Nutrient Management (SSNM) and Farmer's practices (FP). The spacing was 60 cm × 25 cm. There were 5 rows in each plot. Permanent bed and zero tillage treatment were initiated in year 2012. Permanent bed were made at 60 cm with the help of tractor drawn FIRBS. These permanent beds were reshaped every year before sowing of maize. In permanent beds and zero tillage sowing was done manually. In conventional tillage there were four harrowing followed by leveling and sowing was done by tractor drawn furrow opener. Recommended dose of nutrient was 120: 60: 40 N: P₂O₅: K₂O kg/ha. In farmer practices, their thirty maize growing farmers were selected and their nutrient dose was used for farmer's practices treatment. This was 93: 64: 32N: P₂O₅: K₂O kg/ha. In Site specific nutrient management nutrient dose was calculated by a computer software

programme developed by International Plant Nutrition Institute in India (Majumdar *et al.*, 2013) was 120: 30: 46 N: P₂O₅: K₂O kg/ha. In year 2017 crop was sown on 19th July and harvested on 2nd November while in 2018 sowing was done on 19th July and harvested on 29th October. Plots were hand weeded with the help of hoe regularly. Observations on disease severity were recorded at 40, 55, 70 and 85 days after sowing using 1-9 rating scale (Hooda *et al.*, 2018). Per cent diseases

Index (PDI) was calculate using formula given by Wheeler (1969).

$$PDI = \frac{\text{Sum of all disese ratings}}{\text{Total no.of observation} \times \text{Highest disease rating scale}} \times 100$$

Data was statistically analyzed using online programme “OPSTAT” a Statistical Software Package for Agricultural Research Workers developed by Sheoran *et al.*, (1998).

Maydis leaf blight (MLB) rating scale (Hooda *et al.*, 2018).

Scale	Degree of infection	Diseased leaf area(%)
1.0	Nil to very slight infection	≤10 %
2.0	Slight infection, a few lesions scattered on two lower leaves	10.1-20 %
3.0	Light infection, moderate number of lesions scattered on four lower leaves	20.1-30 %
4.0	Light infection, moderate number of lesions scattered on lower leaves, a few lesions scattered on middle leaves below the cob	30.1-40 %
5.0	Moderate infection, abundant number of lesions scattered on lower leaves, moderate number of lesions scattered on middle leaves below the cob	40.1-50 %
6.0	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 %
7.0	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 %
8.0	Very heavy infection, lesions abundant scattered on lower and middle leaves and spreading up to the flag leaf	70.1-80 %
9.0	Very heavy infection, lesions abundant scattered on almost all the leaves, plant prematurely dried and killed	>80 %

Results and Discussion

Effect of tillage practices on severity of maydis leaf blight

Disease severity measured in terms of Percent Disease Index (PDI) at different interval showed that different tillage practices taken as main plot and different nutrient management practices as sub plots were significantly

different but their interaction was found statistically significant (Table 1).

Effect of different tillage practices on Maydis leaf blight after 40 days of sowing, in the year 2017 was significantly lower in conventional tillage (14.57 %) followed by permanent beds (16.54 %) and zero tillage (18.77 %). Similar trend was observed in 2018 and significantly lower disease severity was recorded in

conventional tillage (15.31 %) followed by permanent beds (17.38 %) and zero tillage (20.00 %). Similarly on pooled basis also lower severity was recorded in conventional tillage (14.94 %) followed by permanent beds (16.96 %) and zero tillage (19.38 %).

Significantly lower severity of Maydis leaf blight were recorded in Conventional tillage (16.54 %) followed by permanent beds (19.51 %) and zero tillage (22.72 %) after 55 days of sowing, in the year 2017. Similar trend was found on pooled basis where lower severity was recorded in conventional tillage (16.91 %) followed by permanent beds (20.49 %), and Zero tillage (23.95 %), while in 2018 significantly lower severity was observed in conventional tillage (17.29 %) and permanent beds (21.48 %) followed by zero tillage (25.19 %).

During the year 2017, 2018 and on pooled basis after 70 days of sowing significantly lower severity of Maydis leaf blight was recorded in conventional tillage with 22.22, 23.46, 22.84 followed by permanent beds 25.68, 27.41, 26.54 and zero tillage 28.39, 30.37, 29.38 percent, respectively. After 85 days of sowing significantly lower severity was observed in conventional tillage with 28.39, 27.90, 28.15 followed by permanent beds 31.85, 31.85, 31.85 % and zero tillage 36.30, 36.05, 36.17 percent, respectively.

Effect of nutrient management on severity of Maydis leaf blight of maize

After 40 days of sowing in year 2017 lower severity of Maydis leaf blight was noticed in Site specific nutrient management (13.58 %) and Recommended dose of fertilizer (17.04 %) which was at par, followed by Farmers practices (19.26 %) while, in 2018 lower severity of Maydis leaf blight was recorded in SSNM (14.32 %) followed by RDF (17.88 %) and FP (20.49 %). Similarly on pooled basis

lower severity was observed in SSNM (13.95 %) followed by RDF (17.46 %) and FP (19.88 %).

During the year 2017, 2018 and on pooled basis after 55 days of sowing significantly lower severity of Maydis leaf blight was recorded in SSNM (15.80, 16.79, 16.30 %) followed by RDF (20.49, 22.47 21.48 %) and FP (22.47, 24.69, 23.58 percent, respectively). Similar trend was found at 70 days after sowing where significantly lower severity of Maydis leaf blight was observed in SSNM (20.49, 21.24, 20.87 %) followed by RDF (26.67, 28.64, 27.66 %) and FP 29.14, 31.36 and 30.25 percent, respectively).

After 85 days of sowing in the year 2017 significantly lower severity of Maydis leaf blight was recorded in SSNM (25.93 %) followed by RDF (33.58 %) and FP (37.04 %) while in year 2018 also significantly lower severity was recorded in SSNM (25.68 %) followed by RDF (33.58 %) and FP (36.54 %). Similar trend was observed on pooled basis where significantly lower severity (25.80 %) was recorded in SSNM followed by RDF (33.58 %) and FP (36.79 %).

Effect of tillage and nutrient management practices on yield

The data on yield parameters of maize as influenced by different Tillage practice have been shown in Table 2 In year 2017 and on pooled basis no significant difference was found in grain yield as well as thousand grain weight whereas in the year 2018 significantly higher grain yield was recorded in permanent beds (5.817 t/ha) which was found at par with conventional tillage (5.748 t/ha) whereas minimum yield was recorded in zero tillage (5.617 t/ha). In year 2018 significantly higher thousand grain weight was recorded in conventional tillage (306 g) which was at par with permanent beds (305 g), followed by zero tillage (282 g).

Table.1 Effect of tillage practices and nutrition management on severity (PDI) of Maydis leaf blight

Main Plot	Sub plot	40 DAS			55 DAS			70 DAS			85 DAS			
		2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	
Tillage practices	Nutrition management													
	Permanent beds	Recommended dose of fertilizer	17.04	18.08	17.56	20.74	22.96	21.85	27.41	29.63	28.52	33.34	34.08	33.71
	Farmer's practice	19.26	20.00	19.63	22.22	25.18	23.70	28.89	31.11	30.00	37.04	35.56	36.30	
	Site Specific nutrient management	13.33	14.07	13.70	15.56	16.30	15.93	20.74	21.48	21.11	25.18	25.92	25.55	
Conventional tillage	Recommended dose of fertilizer	14.82	15.56	15.19	17.04	17.78	17.41	22.96	24.45	23.71	29.63	28.89	29.26	
	Farmers practice	17.04	17.78	17.41	19.26	20.00	19.63	25.93	28.15	27.04	32.59	32.59	32.59	
	Site Specific nutrient management	11.85	12.59	12.22	13.33	14.08	13.70	17.78	17.78	17.78	22.96	22.22	22.59	
Zero tillage	Recommended dose of fertilizer	19.26	20.00	19.63	23.70	26.67	25.19	29.63	31.85	30.74	37.78	37.78	37.78	
	Farmers practice	21.48	23.70	22.59	25.93	28.89	27.41	32.59	34.82	33.70	41.48	41.48	41.48	
	Site Specific nutrient management	15.56	16.30	15.93	18.52	20.00	19.26	22.96	24.44	23.70	29.63	28.89	29.26	
Tillage														
Permanent beds		16.54	17.38	16.96	19.51	21.48	20.49	25.68	27.41	26.54	31.85	31.85	31.85	
Conventional tillage		14.57	15.31	14.94	16.54	17.29	16.91	22.22	23.46	22.84	28.39	27.90	28.15	
Zero tillage		18.77	20.00	19.38	22.72	25.19	23.95	28.39	30.37	29.38	36.30	36.05	36.17	
SE(m)		0.14	0.43	0.24	0.22	0.38	0.30	0.25	0.38	0.30	0.14	0.33	0.19	
CD @ 5%		0.58	1.72	0.98	0.91	1.52	1.20	1.00	1.52	1.20	0.58	1.35	0.76	
Nutrition														
Recommended dose of fertilizer		17.04	17.88	17.46	20.49	22.47	21.48	26.67	28.64	27.66	33.58	33.58	33.58	
Farmer's practice		19.26	20.49	19.88	22.47	24.69	23.58	29.14	31.36	30.25	37.04	36.54	36.79	
Site Specific nutrient management		13.58	14.32	13.95	15.80	16.79	16.30	20.49	21.24	20.87	25.93	25.68	25.80	
SE(m)		0.61	1.04	0.81	0.72	0.98	0.83	0.84	1.03	0.93	1.04	1.08	1.05	
CD @ 5%		1.89	3.23	2.52	2.24	3.06	2.59	2.63	3.20	2.90	3.25	3.37	3.26	

*DAS- Days after sowing

Table.2 Effect of tillage practices and nutrition management on yield

Main Plot	Sub plot	Grain yield (t/ha)			1000 Grain weight (g)		
		2017	2018	Pooled	2017	2018	Pooled
Tillage practices	Nutrition management						
Permanent beds	Recommended dose of fertilizer	6.097	5.361	5.729	288	302	295
	Farmer's practice	5.350	5.049	5.200	280	309	295
	Site Specific nutrient management	6.004	5.136	5.570	286	305	296
Conventional tillage	Recommended dose of fertilizer	5.992	5.521	5.756	282	309	295
	Farmers practice	5.312	5.029	5.171	280	306	293
	Site Specific nutrient management	5.939	5.196	5.568	290	303	297
Zero tillage	Recommended dose of fertilizer	5.929	4.649	5.289	289	280	284
	Farmers practice	5.149	4.327	4.739	283	282	283
	Site Specific nutrient management	5.774	4.471	5.123	284	284	285
Tillage							
Permanent beds		5.817	5.182	5.500	285	305	295
Conventional tillage		5.748	5.249	5.498	284	306	295
Zero tillage		5.617	4.482	5.050	285	282	284
SE(m)		0.144	0.107	0.118	3	4	3
CD @ 5%		NS	0.432	NS	NS	16	NS
Nutrition							
Recommended dose of fertilizer		6.006	5.177	5.591	286	297	292
Farmer's practice		5.271	4.802	5.036	281	299	290
Site Specific nutrient management		5.905	4.935	5.420	287	297	292
SE(m)		0.144	0.229	0.111	4	5	3
CD @ 5%		0.448	NS	0.345	NS	NS	NS

After comparing various tillage practices it is clear that conventional tillage practices gave maximum grain yield, followed by minimum tillage and zero tillage. These results are supported by findings of Khurshid *et al.*, (2006) and Khan *et al.*, (2001) elucidated that 1000-grain weight of maize significantly increased in conventional till plots rather than no tilled plots.

Nutrient management significantly influence grain yield (Table 2). Grain yield recorded in RDF (6.006 t/ha) was at par with SSNM (5.905 t/ha) followed by FP (5.271 t/ha). In year 2018 no significant difference was found in grain yield. On pooled basis significantly higher grain yield was recorded in RDF (5.591 t/ha) which was found with at par SSNM (5.420 t/ha), followed by FP (5.036 t/ha). In year 2017, 2018 and on pooled basis no significant difference was found on thousand grains weight.

The higher grain yield of maize was mainly due to SSNM approach was ascribed due to higher but balanced nutrient application. This was evident through the findings of Jayaprakash *et al.*, (2006), Kumar *et al.*, (2007) and Umesh (2008) who reported higher grain yield of maize with application of SSNM and STCR.

No significant difference was found on thousand grain weight due to nutrition management. The result confirms the findings of Sharar *et al.*, 2003, who reported that the yield attributes increased with increased levels of fertilizer. While, Sivamurugan *et al.*, (2017) reported that RDF registered the highest 100 seed weight and it was comparable with STCR but superior to SSNM.

In conclusion the results of present study indicated that conventional tillage practice integrated with Site specific nutrient

management were found good with respect to minimize the severity of maydis leaf blight but permanent raised beds and recommended dose of fertilizer provided higher yield than conventional tillage and site specific nutrient management which was at par. Zero tillage and farmer's practice was found least effective with respect to disease severity and yield.

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