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Varietal performance against blast and cercospora leaf spot of finger millet under different cultivation schemes

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Abstract

Finger millet is the fourth-ranked cereal crop after rice, maize, and wheat in Nepal and ranks first among the mandate hill crops in terms of importance and priority. However, the blast disease caused by *Pyricularia grisea* and cercospora leaf spot caused by *Cercospora eleusinis* is reported to cause a significant reduction in the production of this crop. Therefore, the investigation was conducted at the research farm of the Institute of Agriculture and Animal Science, Sundarbazar, Lamjung, from June to November 2016 to compare varietal resistance and cultivation schemes against blast and cercospora leaf spot. The experiment was laid out in a split-plot design where four varieties of finger millet; Okhale 1, Kabre Kodo 1, Dalle Kodo 1, Kabre Kodo 2 were kept as the main plot factor while planting methods; System of Crop Intensification and Conventional transplanting were kept as subplot factor and replicated thrice. Scoring was done based on the recommended scale of (0-9) at 7-day intervals for leaf blast and cercospora leaf spot. In addition, the percentage of disease incidence was calculated for neck and finger blast. The area under the disease progress curve (AUDPC) and disease severities were not significantly different between tested varieties and planting methods for both diseases. Comparing neck blast incidence, Kabre Kodo1 showed the highest incidence of 1.85%. However, the finger blast was more on Dalle 1 with 1.81% incidence and the conventional transplanting method showed an incidence of 1.26%.

Keywords – AUDPC – Disease severity – Incidence – *Pyricularia grisea*

Introduction

Finger millet [*Eleusine coracana* (L.) Gaertn.] is an important cereal crop widely grown by subsistence farmers in Africa and South Asia (Goron & Raizada 2015). In Nepal, it is the fourth cereal crop after rice, maize, and wheat and ranks first among the mandate hill crops in terms of importance and priority (Upreti 2003).

Finger millet production is constrained by the number of diseases, insects, and abiotic stresses impeding the realization of high yield potential. Blast caused by *Pyriculaia grisea* (Cooke) Sacc [teleomorph: *Magnaporthe grisea* (Hebert) Barr], is the most important disease limiting the production of the crop, which can cause up to 90% loss in yield (Mgonja et al. 2007, Nagaraja et al.

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2007). Finger millet blast is characterized by the appearance of lesions on the leaves, nodes, and head.

Cercospora leaf spot caused by *Cercospora eleusine* is another important fungal disease of finger millet in Nepal (Prasad & Khanal 2005). The symptoms appear as dark, small, and oval spots in the leaf later on, they may become oblong to rectangular in shape. In the stem, lesions are similar to the leaf but tend to be longer (Manandhar et al. 2016). Up to 40% reduction in yield is reported if it occurs immediately after heading (Pradganang 1994). These diseases can be managed with fungicides, the use of resistant varieties, and the adoption of resistant planting methods. However, fungicides are environmentally unfriendly on one hand and costly on the other. So, the adoption of resistant varieties and planting methods can be an alternative to combat the yield losses caused by these diseases. Here, we compare the varietal resistance against blast and cercospora leaf spot of finger millet under different cultivation schemes.

Materials & Methods

The study was carried out at the research farm of the Institute of Agriculture and Animal Science, Sundarbazar, Lamjung from June to November 2016 under a split-plot design where four varieties of finger millet Okhale1 (Okh 1), Kabre Kodo 1 (KK 1), Kabre Kodo 2 (KK 2), Dalle 1 were kept as main plot factor and two planting methods, conventional transplanting (CT) and System of Crop Intensification (SCI) were kept as subplot factor and replicated thrice. Better agronomic practices were followed for the proper growth and development of finger millet. 10 plants from each plot were tagged and scoring was done based on recommended scale '0-9' for leaf blast and cercospora leaf spot at 7 days intervals after the occurrence of disease in the main field. The diseases were confirmed under microscopic examination. The incidence of neck blast and finger blast were calculated during the later stage of the crop. The data collected were processed in MS Excel and analyzed with Genstat and mean comparisons were made with the Duncan Multiple Range Test at a 5% level of significance.

Results

Field experiments were conducted to evaluate disease severities and AUDPC of leaf blast and cercospora leaf spot and to make a calculation of neck blast and finger blast incidence among the tested varieties and planting methods adopted for finger millet. The symptoms of leaf blast appeared as small brown specks which later turn into spindle-shaped spots, several spots coalesce thus causing drying of the leaves. Neck blast was observed causing black and shrunk neck region. Finger blasts appeared at a later stage making the fingers chaffy. The symptoms for the cercospora leaf spot appeared with small dark lesions on the leaves. Both disease severities and AUDPC were not significantly different for varieties tested and planting methods adopted for tested diseases. The highest AUDPC value for leaf blast was of Dalle 1 followed by KK 1, KK 2 and Okhale1. SCI showed the highest AUDPC value than conventional transplanting for leaf blast (Table 1). For cercospora leaf spot AUDPC was highest for KK 2 followed by KK 1, Okhale 1, and Dalle 1. The incidence of neck blast was found the highest for KK 1 and conventional transplanting. In conventional transplanting, KK 1 showed neck blast incidence and in SCI, KK2 showed neck blast incidence. However, the incidence of finger blast was found the highest for Dalle 1 followed by Okhale 1, KK 1, and KK 2 and conventional transplanting followed by the SCI method (Table 2).

Discussion

The present study showed no difference in performance of different finger millet varieties against leaf blast. Similar finding was found on first recorded observation, on the variation among genotypes, with regard to their reaction to blast by Thomas (1940) from erstwhile Madras Presidency who evaluated 15 genotypes and found all of them to be susceptible to blast disease. However, Govindu (1971) evaluated world collection of ragi for resistance to blast and found many of them to be resistant. Conventional transplanting showed the highest AUDPC value than SCI method, it may be due to the crowded population in conventional transplanting, which creates a congenial microclimate environment for the development of diseases. The experiment is also in line with the experiment conducted by (Mwkasege 2015) for the assessment of rice diseases under system of rice intensification in Morogoro, Tanzania where the incidence and severities of rice blast were not significantly different in SRI and farmers practice of conventional transplanting.

Table 1 AUDPC of Leaf blast and Cercospora leaf spot.

S.N.	Factors	Mean				Significance
		Leaf blast		Cercospora leaf spot		
Main plot						
1	Dalle 1	275.8		31.11		
2	KK 1	253.2		32.23		NS
3	KK 2	251		33.95		
4	Okh 1	247.8		31.14		
Sub plot						
1	SCI	269.7		30.88		NS
2	CT	244.2		33.34		
Main plot x Subplot						
		CT	**SCI**	**CT**	**SCI**	
1	Dalle 1	258.1	293.4	35.09	27.12	
2	KK 1	215	291.4	34.77	29.70	NS
3	KK 2	256.9	245.1	31.65	36.25	
4	Okh 1	246.7	248.9	31.83	30.45	

NS = non-significant

Table 2 Incidence of Neck blast and Finger blast.

S.N.	Factors	Incidence (%)			
		Neck blast		Finger blast	
Main plot					
1	Dalle 1	0		1.81	
2	KK 1	1.85		0.725	
3	KK 2	1.26		0.725	
4	Okh 1	0		0.89	
Sub plot					
1	SCI	0.63		0.81	
2	CT	0.92		1.26	
Main plot x Sub plot					
		CT	**SCI**	**CT**	**SCI**
1	Dalle 1	0	0	3.62	0
2	KK 1	3.7	0	1.45	0
3	KK 2	0	2.53	1.45	0
4	Okh 1	0	0	0	1.79

In research carried out at Hill Crop Research Program, Kabre and Regional Agricultural Research Station, Lumle during 2005 and 2006, where 238 genotypes of finger millet developed at HCRP, Kabre and received from International institutions were evaluated where not even a single genotype was found Immune for cercospora leaf spot, whereas 114 and 77 cultivars showed resistant reaction 'score 1' to Cercospora leaf spot in 2005 & 2006 respectively. Similarly, an experiment conducted at Chiba, Japan during the rice growing season, may–September 2008 to assess SRI practice versus conventional practice showed incidence of insect pests and diseases were minimized in SRI compared to non SRI (Chapagain et al. 2011).

Madhukeswara et al. (2004) evaluated 2950 genotypes of ragi for resistance to blast. Of these, 630 genotypes showed resistant to neck blast and 84 were resistant to finger blast. Ghimire &

Pradhanang (1994) reported 60% neck blast and 30-80% finger blast at Lumle, Kaski. Recently up to 40% of neck blast and 25% of finger blast has been reported in farmer's field of hill areas (Prasad 2008).

Conclusions

AUDPC and disease severities were not significantly different between the tested varieties and planting methods adopted for Leaf blast and Cercospora leaf spot. Not any varieties tested showed immune to blast and cercospora leaf spot. The genetic compositions of those varieties and arrangement of those planting methods were unable to show variation in the tested diseases resistance in our location.

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