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Assessment of Avoidable Yield Losses due to Banded Leaf and Sheath Blight in Little Millet

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ABSTRACT

Yield loss assessment in little millet due to banded leaf and sheath blight disease was conducted at Agricultural Research Station, Vizianagaram during *kharif,* 2021. The results of the yield loss assessment study revealed that the disease grade in little millet varied from 1.8 to 8.6. The disease grade in Block V (uninoculated and fungicide treated plot) was recorded the lowest disease grade (1.8) with highest average grain yield (12.05 kg/ha). Similarly, disease grade in Block I where every plant was inoculated was recorded the highest percent disease grade (8.6) with lowest grain yield of 4.63 kg/ha.

Key words: *Banded leaf and sheath blight, Fodder, grain and Yield loss.*

Small millets are the hitherto staple food for millions of people residing in arid and semiarid regions of Asian and African countries and are currently restricted to certain traditional growing areas. Increased health problems, due to changes in lifestyle, have driven people to rethink their food habits and deliberately shift toward nutritional crops, such as small millets (Anuradha *et al*., 2022)**.** Little millet (*Panicum sumatrense* Roth ex Roemer and Schultes), locally known as kutki, mejhari, medois one of the hardiest minor cereal crops belonging to the family Poaceae (Gramineae) and is indigenous to Indian sub-continent. The crop is cultivated by tribal and poor farmers in low fertile soils with low or no cash input for food and feed. It has an excellent rejuvenating capacity compared to other cereal crops. In India, the crop is cultivated in an area of 291 thousand hectares with annual production of 102 thousand tones and productivity of 349 kg per hectare which is very less as compared to other cereal crops. Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Odisha, Tamil Nadu, Karnataka, Jharkhand and Gujarat are major little millet growing states in the country. Millets also sustain adverse climatic conditions thus helping to attain food and nutritional security (Bhat *et al*., 2018). However in situ incorporation of legume green manure crops increases the nutrient uptake, productivity of maize and reduce disease incidence (Sandhya Rani *et al.,* 2022). Similarly in ground nut crop simultaneous selection for stable disease resistant and high yielding groundnut genotypes were identified (Patro *et al*, 2022). Screening of varieties with inbuilt genetic resistance is the best means for management of this disease, as the crop is predominantly grown by resource poor farmers who can hardly afford using chemicals for its control (Das *et al*., 2021).

Studies on management of sheath blight in little millet is meagre in the literature. Now a days people are very conscious to health and they are moving to organic production and consumption. The growing of resistant genotypes of crops is one of the best ways to manage many biotic and abiotic stresses in organic crop production system. Assessing the yield loss helps in identifying the time, when control is needed thereby, effective disease management practices can be adopted which helps to scale down the disease incidence and severity therefore grain yield and fodder yield can be increased significantly which ultimately helps in increasing the returns. Gogoi *et al.* (2020) investigated yield loss assessment in maize due to banded leaf and sheath blight (BLSB) during 2010-2014 under multi-locational fields of Northern *Kharif* India conditions. Result of field experiments revealed

BLSB disease caused 13.66 per cent loss at Delhi during 2012-2013 whereas 20.62 percent yield loss was recorded at Pantnagar during 2011-2013.

Significant loss in grain yield (q/ha) was observed due to BLSB in unprotected plots as compared to protected treatments across different locations. Avoidable yield loss assessment due to banded blight in little millet was conducted at Agricultural Research Station, Vizianagaram during *kharif* 2021-22revealed that the disease incidence ranged from 2.6 -8.6 grade on 1-9 scale with yield loss varied from 50 percent to 97.6 percent and also yield loss increased with increase in severity of disease (Palanna *et al*., 2021).

MATERIAL AND METHODS

Isolation and Identification of the Pathogen Isolates

Little millet leaves and leaf sheaths with typical banded leaf and sheath blight symptoms collected from different locations were used for isolating the pathogen on PDA medium. Leaf bits of four mm^2 with healthy and infected leaf portion were surface sterilized using 1% Sodium hypo Chlorite for a minute followed by rinsing in sterilized distilled water thrice to remove the disinfectant. The leaf bits were placed in between two layers of sterile blotting sheets to remove moisture and then transferred aseptically to PDA plates and incubated at 27±1°C in incubator. Inoculated petriplates were observed for mycelial growth of the pathogen after every 24 hours. Two-day old mycelial bits developed from diseased leaf were aseptically transferred to glass slide and observations were made to confirm the identity based on morphological characters (hyphal width, angle of branching and septation). The obtained pathogen cultures were sub-cultured on PDA after confirmation (Singh *et al.,*2018).

Purification and maintenance of Pathogen Isolates

Different isolates obtained from infected tissue were purified further by single hyphal tip method. The mycelial bit was taken out with the help of sterilized cork borer and aseptically transferred to Petri plates containing 2% solidified water agar and incubated at 27±1°C. Individual hyphal tips spaced apart were examined under microscope and marked carefully using permanent marker and transferring on to fresh PDA plate and incubated. The pure culture, thus obtained was sub-cultured on to PDA slants and incubated at 27±1°C and fully grown cultures were preserved in a refrigerator at 4°C for further use (Debbarma and Dutta, 2015).

Inoculum preparation

Inoculum of each test isolate was multiplied on barley grains following the method devised by Shekhar and Kumar (2012). The grains washed in running tap water were soaked in sterilized distilled water for 24 h, such pre-soaked grains were (40 g) filled in Erlenmeyer flask (250 ml) and autoclaved twice at 15 psi for 30 minutes with an interval of 24 h. Each flask was shaken to avoid formation of grain clots and then inoculated with five mm discs of actively grown three-day old pure cultures of *R. solani* isolates individually. The flasks were then incubated at 27±1°C for10 days by intermittent shaking for uniform fungal growth on grains.

Assessment of Avoidable Yield Losses Due to BLSB in little millet

A field experiment was conducted to evaluate the effect of different levels of banded blight disease on finger millet yield by artificial inoculation of pathogen in five different blocks (Table 1). A graded level of disease intensity was done by manipulating the artificial inoculation of pathogen. Artificial inoculation (Soil inoculation) was done at 30-35 days after sowing on disease susceptible variety. Soil inoculation was done by mass multiplication of pathogen on sterilized barley grains and later the grains were mixed deep in the soil before sowing of the crop so that effective inoculum was provided. A total area of 250m^2 (200 m^2 for the inoculated treatments and 50 m^2 for the uninoculated treatment) was used for the experiment. The 200 m^2 area marked for inoculation was further divided into four blocks of 50 m^2 each to create graded level of disease: For sheath blight in Block I, all the plants were inoculated (soil inoculation); in Block II alternate plants was inoculated and in Block III, one in each three plants was inoculated and Block IV, no inoculation and no protection (natural infection) and Block V, Un-inoculated and fungicide treated control plot. Disease data was recorded on the basis of lesion length by using 0 to 9 scale (Table 2) (Hariprasanna *et al*., 2022) and yield data was recorded.

Table1. Treatments of avoidable yield losses due to BLSB in little millet

S.No	Block	Particulars
1	Block I (T1)	All the plants were inoculated (soil inoculation)
2	BlockII (T2)	Alternate plants were inoculated (soil inoculation)
3	BlockIII (T3)	One in each three plants was inoculated (soil inoculation)
4	BlockIV (T4)	No inoculation and no protection (natural infection) to create different level of disease intensity.
5	BlockV (T5)	Un-inoculated + fungicide treated control plot

Table 2: Banded blight rating (1-9 scale)

Score	Description	Reaction
1	<1% of plant area covered by lesion	Highly Resistant (HR)
2	1-5% of plant area covered by lesion	Resistant (R)
3	6-10% of plant area covered by lesion	
4	11-20% of plant area covered by lesion	Moderately Resistant (MR)
5	21-30% of plant area covered by lesion	
6	31-40% of plant area covered by lesion	Susceptible (S)
7	41-50% of plant area covered by lesion	
8	51-75% of plant area covered by lesion	Highly Susceptible (HS)
9	>75% of plant area covered by lesion	

Table 3: Assessment of avoidable yield losses due to Banded blight in Little millet

Particulars	Grade	GrainYield (Kg/ha)	% decrease over control (Protecte	Fodder yield (Kg/ha)	% decrease over control (Protected
BlockI (T1):All the plants Inoculated (soil inoculation)	8.6	4.63	61.5	30.4	36.5
Block II (T2): Alternate plants should be inoculated (soil inoculation)	8.2	5.2	56.8	33.3	30.4
BlockIII (T3): One in each three plants should be Inoculated (soil inoculation)	7.8	5.83	51.6	34	29
Block IV (T4): No inoculation and no protection (natural infection) to create different level of disease intensity.	7.4	6.2	48.5	35.3	26.3
Block V (T5): Un-inoculated+ Fungicide treated control plot	1.8	12.05	--	47.9	--
C.D.(5%)	**0.94**	**1.05**		**5.94**	
C.D.(1%)	**1.29**	**1.44**		**8.18**	
C.V.(%)	**10.36**	**11.64**		**12.38**	

Statistical Analysis

The observations recorded in the various experiments of the study were statistically by following the standard procedures given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Assessment of avoidable yield losses due to BLSB in little millet

The results of the yield loss assessment in little millet revealed that, banded blight grade varied from 1.8 to

8.6 at different levels *of R. solani* inoculum. Disease grade in Block V (un-inoculated and fungicide treated plot) was significantly recorded the lowest disease grade (1.8) with highest average grain yield (12.05 kg ha^{-1}). Similarly, disease grade in Block I where all plants were inoculated was recorded highest disease grade (8.6%) with lowest grain yield of 4.63 kg/ha is on par with Block II where alternate plants were inoculated (Table 3).

As this is the new research study in millets, there is limited literature available. Palanna *et al.* (2021) in an annual progress report of AICRP small millets studies on avoidable yield loss assessment due to banded blight in prosomillet revealed that the disease incidence ranged from 2.6 -8.6 G on 1-9 scale with yield loss varied from 50 percent to 97.6 percent and also yield loss increased with increase in severity of disease.

The results from the yield loss assessment study showed that disease grade in Block V which was un-inoculated as well as fungicide treated plot is the lowest (1.8 %) with highest grain yield (12.05 kg ha^{-1}). Similarly, disease grade in Block I where all the plants were soil inoculated is the highest (8.6%) with lower grain yield of 4.63 kg ha^{-1} indicating yield loss increased with increase in severity of the disease. Adoption of effective management strategies against BLSB results in decrease of PDI which ultimately helps in reducing the yield losses.

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