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Study of irrigation regimes and nutrient management practices on silkworm disease incidence

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Abstract

Field experiments were conducted at field No. 68 of Eastern Block, Department of Sericulture, Tamil Nadu Agricultural University, Coimbatore during 2015-2016. Investigations were undertaken on mulberry variety victory-1(V1) to evaluate "Study of irrigation regimes and nutrient management practices on disease incidence of silkworm". In double hybrid silkworm among the irrigation regimes, 0.9 IW/ CPE ratio of irrigation (I₂) has recorded the lowest flacherie and grasserie disease incidence of 3.75 per cent and 1.75 per cent. The different nutrient management practices significantly influenced the disease incidence of double hybrid silkworm. One hundred per cent inorganic fertilizers application (N₂) which recorded the lowest flacherie and grasserie disease incidence of 3.25 per cent and 1.25 per cent. The interaction effect of irrigation and nutrient management practices did not significantly influence on the flacherie and grasserie disease incidence in double hybrid silkworm. In cross breed silkworm among the irrigation regimes, 0.9 IW/ CPE ratio of irrigation (I₂) has recorded the lowest flacherie and grasserie disease incidence of 4.00 per cent and 1.75 per cent. The different nutrient management practices significantly influenced the flacherie and grasserie disease incidences. One hundred per cent inorganic fertilizers application (N₂) has recorded the lowest flacherie disease incidence of 4.00 per cent. Fifty per cent inorganic and 50 per cent organic manures application (N₃) has recorded the lowest grasserie disease incidence of 2.00 per cent. The interaction effect of irrigation and nutrient management practices did not significantly influence on the flacherie and grasserie disease incidence.

Keywords: Mulberry, Silkworm, Irrigation, Nutrients, flacherie and grasserie disease

Introduction

Silk, a naturally produced animal fiber of unparalleled grandeur and is rightly called as "The Queen of Textiles". It is characterized by exquisite qualities like the natural sheen, inherent affinity for dyes, vibrant colours, high absorbance, light weight, resilience, excellent drape quality etc. Different kinds of silkworms produced different qualities of silks. The best kind of silk is mulberry silk. It is produced by mulberry silkworm, *Bombyxmori* L. The name comes from the plant, which it feeds on. Mulberry (*Morusalba* L.) is a perennial, deep rooted, fast growing and high biomass producing foliage plant.

Sudhakar *et al.*, (2018) [7] reported that the nutrients are taken up by the plants in solution form for which soil moisture without nutrients is of no use to the plants. The sustainability of any production system requires optimum utilization of resources be it water, fertilizer or soil. Irrigation is the artificial application of water which aims to maintain the soil moisture required for an optimum in plant growth.

Sugan (1999) [8] reported that although the cocoon crop production was not up considerably in the past few years. The increase was said to be more horizontal than vertical. One of the factors attributed for the low productivity in crop loss was diseases. Incidence of diseases from major sericulture areas indicated that annual crop loss due to diseases was to the current of 30 to 40 per cent. Flacherie, grasserie, muscardine and pebrine were reported to be the major diseases accounting for crop loss besides Uzi infestation.

Flacherie disease is known to be predominant causing about 20 to 40 per cent crop loss (Shymala *et al.*, 1981) [5]. Patil and Sharadamma (1999) [3] reported that grasserie and flacherie were the most serious maladies among silkworm diseases. These diseases mainly occurred during summer and rainy seasons and the annual crop loss was more than 30 per cent.

Singh *et al.*, (1994) [6] reported that the tender leaf fed group in both treated and untreated control showed maximum susceptibility and mortality due to nuclear polyhedrosis in both breeds (NB18 and NB4D2). This susceptibility may be due to the increased water and decreased carbohydrates content in tender leaf accompanied by affecting pH of gut medium and resistance to infection (Anon., 1980) [1]. Basavarajappa and Savanurmth (1997) [2]

reported the highest incidence of grasserie and cocoon melting in all silkworm breeds when tender, over mature and wet leaves were fed. The cross-breed PM X NB18 showed highest mortality (21.1 and 27.9%, respectively) when fed with wet leaves. Likewise NB18 and NB4D2 breeds developed the highest incidence of grasserie when fed with tender and over mature leaves.

Materials and Methods

Field experiments were conducted in an established mulberry garden with Victory.1 variety in field No. 68 of Eastern Block, Department of Sericulture, Tamil Nadu Agricultural University, Coimbatore which is located at 11° North Latitude, 77° East Longitude and at an altitude of 426.7 m above mean sea level (MSL). Field experiments and laboratory studies (silkworm rearing) were carried after successive pruning's of mulberry as per the schedule given below.

Crops after	Experiment	
	Field study	Silkworm Rearing
I pruning	10.06.2015 - 11.08.2015	22.07.2015 - 16.08.2015
II pruning	14.08.2015 - 17.10.2015	21.09.2015 - 17.10.2015
III pruning	19.10.2015 - 21.12.2015	01.12.2015 - 26.12.2015
IV pruning	14.01.2016 - 16.03.2016	16.02.2016 - 20.03.2016

Silkworm egg

Disease Free Laying's (DFL's) of the cross breed (PM X CSR 2) and double hybrid (DH1) {(CSR2 X CSR 27) X (CSR 6 X CSR 26)} were obtained from the Silkworm Seed Production Centre, Coimbatore under the control of Central Silk Board. The selected breed was suitable for all seasons in Tamil Nadu.

Experimental details

The experiments were laid out in split plot design in three replications. The selected crop is mulberry, Victory 1 (V1) variety and four times pruning's were done.

The treatment details are as follows:

I. Main plot (Irrigation Regimes)	
I ₁	: Irrigation at 5 cm depth - 1.2 IW/ CPE Ratio
I ₂	: Irrigation at 5 cm depth - 0.9 IW/ CPE Ratio
I ₃	: Irrigation at 5 cm depth - 0.6 IW/ CPE Ratio
I ₄	: Control (IW/ CPE Ratio 1.0)
II. Sub plot (Integrated Nutrient Management (INM))	
N ₁	: Absolute control (No organic & Inorganic).
N ₂	: 100 per cent Inorganic fertilizers (NPK 375:140:140 Kg/ha/year)
N ₃	: 50 per cent Inorganic fertilizers + 50 per cent Organic manures (25 per cent Vermicompost* + 25 per cent Biofertilizer**)
N ₄	: 100 per cent Organic manures (50 per cent Vermicompost* + 50 per cent Biofertilizer**)

*Vermicompost @ 8 MT/ha/yr.

**Biofertilizer (Potash Solubilizing bacteria - *Bacillus mucilaginosus*) @ 12.5 Kg/ha/year.

Grasserie disease incidence (per cent)

The grasserie disease incidence was recorded at the end of fifth instar and spinning stage and expressed in per cent.

Flacherie disease incidence (per cent)

The flacherie disease incidence was recorded at the end of fifth instar and spinning stage and express in per cent.

Statistical analysis

The data collected during the experimental period were analyzed statistically by analysis of variance method with respective design as suggested by Gomez and Gomez (1976).

Result

Influence of irrigation and nutrient management on silkworm disease incidence Double hybrid - Flacherie disease incidence

Irrigation regimes and nutrient management practices had significant influence on flacherie disease incidence (%) in double hybrid, which is evident from the results presented in the Table 1.

Table 1: Effects of irrigation regimes and nutrient management practices on silkworm double hybrid disease incidence

Treatments	Flacherie disease incidence (per cent)					Grasserie disease incidence (per cent)				
	N ₁	N ₂	N ₃	N ₄	Mean	N ₁	N ₂	N ₃	N ₄	Mean
I ₁	7.00	3.00	4.00	4.00	4.50 ^c	4.00	1.00	2.00	1.00	2.25 ^b
I ₂	6.00	2.00	3.00	4.00	3.75 ^d	3.00	1.00	1.00	2.00	1.75 ^c
I ₃	8.00	5.00	6.00	7.00	6.50 ^a	4.00	1.00	2.00	2.00	2.25 ^b
I ₄	7.00	3.00	4.00	5.00	4.75 ^b	4.00	2.00	2.00	2.00	2.50 ^a
Mean	7.00 ^a	3.25 ^d	4.25 ^c	5.00 ^b		3.75 ^a	1.25 ^d	1.75 ^c	2.00 ^b	
	SED		CD (0.05)			SED		CD(0.05)		
I	0.02		0.05			0.02		0.05		
N	0.04		0.08			0.04		0.08		
I×N	0.06		NS			0.06		NS		
N×I	0.06		NS			0.06		NS		

Among the irrigation regimes, 0.9 IW/ CPE ratio of irrigation (I₂) has recorded the lowest flacherie disease incidence of 3.75 per cent. This is followed by 1.0 IW/ CPE ratio of irrigation (I₄) which registered a value of 4.75 per cent and 4.50 per cent was recorded in 1.2 IW/ CPE ratio of irrigation (I₁). The highest flacherie disease incidence of 6.50 per cent was recorded in IW/ CPE ratio of 0.6 (I₃).

The different nutrient management practices significantly influenced the disease incidence of double hybrid silkworm. One hundred per cent inorganic fertilizers

application (N₂) which recorded the lowest flacherie disease incidence of 3.25 per cent, followed by 50 per cent inorganic and 50 per cent organic manures application (N₃) has recorded 4.25 per cent and 5.00 per cent in 100 per cent organic manures application (N₄). The highest flacherie disease incidence of 7.00 per cent was recorded in the absolute control (N₁).

The interaction effect of irrigation and nutrient management practices did not significantly influence on the flacherie disease incidence.

Double hybrid - Grasserie disease incidence

Irrigation regimes and nutrient management practices had significant influence on grasserie disease incidence (%) in double hybrid, which is conspicuous from the results presented in the Table 1.

Among the irrigation regimes, 0.9 IW/ CPE ratio of irrigation (I₂) has recorded the lowest grasserie disease incidence of 1.75 per cent, which was followed by 1.2 IW/ CPE ratio of irrigation (I₁) which registered the value of 2.25 per cent. The highest grasserie disease incidence of 3.50 per cent was recorded in IW/ CPE ratio of 0.6 (I₃).

Regarding the different nutrient management practices, 100 per cent inorganic fertilizers application (N₂) has recorded the lowest grasserie disease incidence of

1.25 per cent. The highest grasserie disease incidence of 3.75 per cent was recorded in the absolute control (N₁). The interaction effect of irrigation and nutrient management practices did not significantly influence on the grasserie disease incidence.

Cross breed - Flacherie disease incidence

Both irrigation regimes and nutrient management practices had significant influence on flacherie disease incidence (per cent) in cross breed, which is clear from the results presented in the Table 2. Irrigation regimes, 0.9 IW/ CPE ratio of

irrigation (I₂) has recorded the lowest flacherie disease incidence of 4.00 per cent, which was followed by 1.0 IW/ CPE ratio of irrigation (I₄) with a value of 4.75 per cent and 5.25 per cent was recorded in 1.2 IW/ CPE ratio of irrigation (I₁). The highest flacherie disease incidence of 7.25 per cent was recorded in IW/ CPE ratio of 0.6 (I₃). The different nutrient management practices significantly influenced the flacherie disease incidences of cross breed. One hundred per cent inorganic fertilizers application (N₂) has recorded the lowest flacherie disease incidence of 4.00 per cent. The highest flacherie disease incidence of 7.00 per cent was recorded in the absolute control (N₁). The interaction effect of irrigation and nutrient management practices did not significantly influence on the flacherie disease incidence.

Cross breed - Grasserie disease incidence

Both irrigation regimes and nutrient management practices had significant influence on grasserie disease incidence (per cent) in cross breed, which is conspicuous from the results presented in the Table 2. Among the irrigation regimes, 0.9 IW/ CPE ratio of irrigation (I₂) has recorded the lowest grasserie disease incidence of 1.75 per cent. The highest grasserie disease incidence of 3.50 per cent was recorded in 0.6 IW/ CPE ratio of irrigation (I₃).

Table 2: Effects of irrigation regimes and nutrient management practices on silkworm cross breed disease incidence

Treatments	Flacherie disease incidence (per cent)					Grasserie disease incidence (per cent)				
	N ₁	N ₂	N ₃	N ₄	Mean	N ₁	N ₂	N ₃	N ₄	Mean
I ₁	7.00	4.00	5.00	5.00	5.25 ^b	4.00	2.00	2.00	2.00	2.50 ^c
I ₂	6.00	3.00	3.00	4.00	4.00 ^d	3.00	1.00	1.00	2.00	1.75 ^d
I ₃	9.00	5.00	7.00	8.00	7.25 ^a	5.00	3.00	3.00	3.00	3.50 ^a
I ₄	6.00	4.00	4.00	5.00	4.75 ^c	4.00	3.00	2.00	3.00	3.00 ^b
Mean	7.00 ^a	4.00 ^d	4.75 ^c	5.50 ^b		4.00 ^a	2.25 ^c	2.00 ^d	2.50 ^b	
	SED		CD (0.05)			SED		CD(0.05)		
I	0.04		0.12			0.02		0.06		
N	0.04		0.09			0.04		0.08		
I×N	0.08		NS			0.07		NS		
N×I	0.08		NS			0.07		NS		

The different nutrient management practices had significantly influence on grasserie disease incidence of cross breed. Fifty per cent inorganic and 50 per cent organic manures application (N₃) has recorded the lowest grasserie disease incidence of 2.00 per cent. The highest grasserie disease incidence of 4.00 per cent was recorded in the absolute control (N₁). The interaction effect of irrigation and nutrient management practices did not significantly influence on the grasserie disease incidence.

Discussion

Both double hybrid and cross breed silkworm investigated in the treatment of irrigation regimes showed significant differences in flacherie and grasserie diseases occurrence which was found to be significantly less in the irrigation of 5 cm depth at 0.9 IW/CPE ratio (I₂). Similarly, application of irrigation at 0.8 IW/CPE ratio increased the mulberry yield at the same time it has slow down the aging of mulberry leaves and improved the leaf quality, which has reduced the silkworm diseases viz., flacherie and grasserie (Xiaojun, 2008). Grasserie and flacherie diseases incidence recorded no significant differences in nutrients management practices and these interaction effect also. This may be due to dirty, aged and poor quality diseased leaves fed to silkworms (Praveena *et al.*, 2011) ^[4].

Conclusion

In the present investigation on “Study of irrigation regimes and nutrient management practices on diseases of silkworm” applying irrigation water 5 cm depth at 0.90 IW/CPE ratio, 50% inorganic fertilizers and 50% organic manures and One hundred per cent inorganic fertilizers application (N₂) has performed better than all other treatment.

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