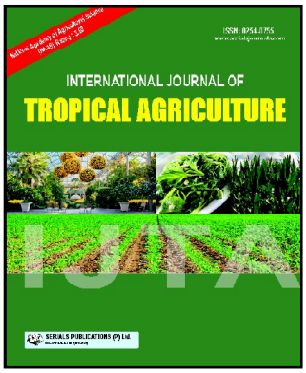

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www.serialsjournal.com

Volume 35 • Number 4 • 2017

Drought Management in Mulberry Sericulture in Scarce Rainfall Zones of Andhra Pradesh, India

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Abstract: Sericulture is the major commercial crop under irrigated conditions in the scarce rainfall zones of Andhra Pradesh. Mulberry cultivation and Silk worm rearing in these areas are frequently affected by drought. Study was conducted to find out the socio economic conditions of sericulturists, problem faced by them during drought periods and their drought management practices. Studies on socio economics parameters revealed that the farmers are middle aged having an average of 21years of experience in sericulture, doing sericulture in 1.7ac with five batches of silkworm rearing and the average uptake of 708dfls / batch with an average yield of 76.6kgs/100dfls. 56 percent of farmers have insufficient water for sericultural activities. Major problems faced by the farmers were dry and desiccating wind (72%), spinning of small sized silk cocoons (71%), Less Silk Ratio (68%), Disease out break (58%) and Drying of leaves (55%). The studies on drought management practices revealed 68 percent of the farmers were medium adopters of drought management technologies and 32 percent are high adopters. 36 percent of technologies have low level of adoption, 6 percent have medium level of adoption and 23 percent of technologies have high level of adoption. Even though 56 percent of the farmers are affected by water shortage the soil moisture management technologies were not followed. Technologies like plantation of drought resistant mulberry varieties,Green manuring, Borewell recharging, rearing temperature tolernt silkworm hybrids are not adopted by the farmers. Not adopting of these technologies leads to poor quality leaf production. But the farmers have good adoption of rearing techniques such as temperature humidity maintenance in rearing (68 to 79%), hygienic rearing (79%), leaf harvesting(94%), preservation (94%) and feeding silkworms(90%). The study suggests for taking suitable efforts to increase adoption of all drought management for the quality silk cocoon production in the drought periods also.

Key words: Mulberry cultivation, Silkworm rearing, Drought management, Problems faced, Adoption of technologies

INTRODUCTION

Sericulture is the major commercial crop under irrigated conditions in the scarce rainfall zones of Andhra Pradesh. Climatic conditions prevailing in this area are more favourable for mulberry cultivation and silk worm rearing. Another factor that governs the localisation of sericulture in the area is severe drought conditions. While all other agricultural crops wither away mulberry crop survives and yields at least two to five crops in a year. Anantapur district which falls under this zone ranks first among the mulberry raw silk producing districts in Andhra Pradesh. In spite of severe drought and low rainfall, mulberry cultivation in Anantapur has increased enormously. Though the district is facing frequent drought and famines, yet sericulture is gaining prominence. Sericulture which was considered as a subsidiary occupation in the past is being considered as major activity. The improved technologies developed by the research institutes transformed sericulture from the traditional nature of production, which existed earlier, to a vibrant enterprise presently. The production and productivity of sericulture has therefore increased many folds. However, the quality is becoming a major concern now days in drought prone areas.

Mulberry cultivation and silkworm rearing in majority of sericulture clusters in Andhra Pradesh states are affected by low rainfall and recurrent drought. Rathnam and Narasaiah [10] stated that sericulture is considered as a boon to many marginal and small farmers in the drought-prone areas and informed that mulberry cultivation and silkworm rearing is more lucrative to the farmers on comparing with the food and other commercial crops. Munikrishnappa *et al.*, [7] stated that the farmers of Anantapur district are interested to rear silkworms throughout the year even though they face severe water shortage during summer period. The quality and quantity of mulberry leaves and silk cocoon productions are severely affected by the drought situations (Mahimasanthi [3]). The crisis of drought besides reducing mulberry yield it also leads to partial or total silkworm crop losses. The cocoon produced during the drought period is of inferior in qualities (Rajaram [9]).

Reacting to drought has proven far more expensive and less efficient than planning beforehand to minimize drought risk. Drought requires management actions, as water availability is insufficient to meet the needs of the same or even higher water demands. (Xerochore, [11]). The ill effects of drought can be alleviated to a considerable extent by adopting Integrated Drought Management technologies as described by Mahimasanthi *et al,* [3]. Chouhan *et al.*, [1] inferred that adoption of the improved technology is the ultimate aim for enhancing the production and income of the farming system. Yadav *et al* [12] recommended that the full adoption of crop production technologies is very important in achieving the desired level of productivity in dry land crops. Presently scientific and technological resources available in the field to reduce the risks are fully, partially or never adopted by the farmers. From the review of the past research it is understood that the ill effects of drought are need to be managed properly and the farmers should be educated properly to mitigate the drought. Hence, this study was conducted to find out the socio economic conditions of sericulturists, problem faced by them during drought periods and their drought management practices

METHODOLOGY

The study was conducted at the sericulture clusters in the scarce rainfall zones of Andhra Pradesh. The average annual rainfall of the study area ranges from 500mm to 750 mm. The hydrometric division of India Meteorological Department reports that the rainfalls received in these areas are not uniform and highly uneven. Recurrence of drought is a common phenomenon in this area. From this zone two major

sericulture clusters namely, Hindupur and Penukonda were selected based on crisis vulnerability. Two Samples of 50 farmers each were selected randomly from these clusters by simple random sampling design to avoid biasness thus constituting a sample size of 100 farmers. The data were collected with the structured interview schedule.

An interview schedule was designed based on the objectives of the study for data collection. Socioeconomic characteristics and drought management technologies recommended by the Central Sericultural Research and Training Institute, Mysore were included in the schedule. The schedule was pre-tested and necessary modifications were made. Data were collected through personal interviews of the sericulture farmers. Adoption of thirty identified technologies such as propagation of drought resistant host plant varieties, Water conservation and moisture management technologies, In-situ rainwater harvesting and conservation methods for mulberry plantations, Management of pruning schedule to avoid rearing in peak summer, rearing of temperature tolerant silkworm hybrids, Rearing practices to be followed during drought conditions such as planning of silkworm rearing schedule, maintenance of rearing shed, Silkworm egg transportation, young age silkworm rearing, Late age rearing and Leaf / shoot harvesting and preservation technologies were studied.

Problems faced by the farmers

Problems faced by the sericulture farmers were collected by personal interviews, compiled and enlisted.

Measurement of extent of adoption

The farmers were found to adopt the technologies at different levels, which were delineated as, nil adoption; a situation where the farmer never adopted the technology, partial adoption; where the adoption of technology was found to be partial or on a limited basis and in another situation, where the farmers were found to adopt the technology in full, as recommended. The adoption behaviour of the selected farmers was computed using the adoption score. The scores were assigned as per the level of adoption. For complete adoption of a technological practice a score of 2 was given and for partial adoption of the same a score of 1 was given, while for non-adoption a score of 0 was given. In all, 30 technologies were considered for the study and given equal weightage. Each technology was given score and summed up for calculating farmer's wise adoption index. Further the farmers were classified into low, medium and high groups based on their adoption score. The adoption index was computed for each farmer as below:

$$Adoption\ index = \frac{Farmer's\ total\ score}{Total\ \ possible\ score} \times 100$$

Where n = 30

Each technology was given score and farmers score under each technology is summed up for calculating Technologywise adoption index. Based on that, technologies were classified into low, medium and high groups based on their adoption score. The adoption index was computed for each technology as below:

$$Technologywise\ Adoption\ index = \frac{Technologywise\ \ farmers\ total\ score}{Total\ \ possible\ score} \times 100$$

Where n = 100

RESULT AND DISCUSSION

Socio-economic profile of sericulturists

Socio-economic characteristics of the sericulture farmers were studied to know the background of the sericulturists in the area. Ten socio-economic variables were selected for the study and analysed (Table 1) which showed that the mean age of the

farmers surveyed were 45 years and 52 per cent of the respondents were middle aged (between 34 and 55 years) group.The highest proportion of the respondents (40%), were educated upto high school (i.e. 6 - 10 standard), 4 per cent upto XII Std, 6 per cent upto degree whereas 26 per cent upto primary and 24 per cent illiterates. The mean experience of the sericulturists was 21 years and 58 percent of the respondents were above the mean level and 42 per cent were below mean (10 years). The mean land holding of the respondents were 6.86 ac and mean mulberry land holding was 1.7ac. Water availability is insufficient for 56 per cent of the respondents for their sericultural activities.

Socio-economic profile of sericulturists in the study area (N = 100)

No.	*Variables*	*%*	*Mean*	*SD*	*No*	*Variables*	*%*	*Mean*	*SD*
1	Age (yrs)		45	10.55	5	Mulberry Acreage(ac)		1.7	0.88
	Young (less than 35)	30				less than mean	54		
	Middle (35-55 years)	52				more than mean	46		
	Old (more than 55yrs)	18			6	Water Availability			
2	Education level		5	3.95		Sufficient	44		
						Insufficient	56		
	Illiterate	24			7	No. of rearing /annum		5	1.98
	Primary	26				less than mean	14		
	High	40				more than mean	86		
	Higher Secondary	4			8	Total DFLs brushed/ac/annum		708	317
	College	6				less than mean	56		
3	Experience in sericulture (yrs)		21	9.23		more than mean	44		
					9	Average Yield (Kg/100 dfls)		76.6	6.71
	less than mean	58				less than mean	46		
	more than mean	42				more than mean	54		
4	Total land holding(ac)		6.86	4.24	10	Gross returns / ac (Rs)		150000	78858
	less than mean	52				less than mean	32		
	more than mean	48				more than mean	68		

SD- Standard Deviation

The farmers in the study area reared 5 to 12 silkworm rearings per annum recording a mean of 5 rearings. The average number of disease free silkworm layings (DFLs) reared by a farmer is recorded as 708 ± 290/ac. The rearing capacity of the farmers ranged between100 to 350 DFLS per batch. The average silk cocoon yield of the farmers is 76.6 kg per 100 dfls, with 6.71 standard deviation. The average gross returns received by the farmer per acre is Rs.150000 ± 78858/- and 68 percent of the respondents were above the average.

Problems faced by the farmers

Problems faced by the farmers in the sericultural clusters is compiled and given in the table 2.

Table 2
Problems faced by the farmers

Sl. No	*Problems faced by the farmers*	*% of farmers expressed*
1	Dry and desiccating wind	72
2	Spinning of Small sized cocoons	71
3	Less Silk Ratio%	68
4	Disease out break	58
5	Heavy water shortage	56
6	Drying of leaves	55
7	Less population of chawki worms	43
8	Unequals in chawki worms	43
9	Higher melting of cocoons	41
10	Lower feeding of worms	25

Major problems faced by the farmers were dry and desiccating wind, spinning of small sized silk cocoons, Less Silk Ratio, Disease out break and Drying of leaves. Mahimasanthi *et al,* [5] reported that by adopting Integrated Drought Management technologies in mulberry cultivation and silkworm rearing will help to produce good quality cocoon in drought periods

Farmerwise Extent of adoption

Adoption level of individual farmers were collected for 30 identified technologies which helped farmers to mitigate the drought (Table 3) 68% of the farmers are medium adoptors i.e, between 30 to 60 level of adoption. 18% of the farmers have high level of adoption. Praveena *et. al.,* [7] reported that half of the respondants had medium level, 28.33percent had low level of adoption and 21.67 percent had high level of adoption respect to scientific management of drought in Agriculture farmers of Ananthapur dist. Krishnamoorthy and Radhakrishnan, [2], reported that special attention is needed to increase the adoption of technologies in mulberry cultivation.

Table 3
Farmer wise extent of Adoption of drought management techniques

Category	*Level (%)*	*Number*	*%*
Low	<30	0	0
Medium	30 - 60	68	68
High	> 60	32	32

Technologywise extent of adoption

To find out the technologywise, the adoption of drought mangement technology by the farmers were studied for all the 30 technologies recommended by research Institutes (Table 4).

Table 4
Technology wise extent of Adoption of drought management techniques

Category	*Level (%)*	*Number*	*%*
Low	<30	18	36
Medium	30 - 60	3	6
High	> 60	9	18

Technology adoption in mulberry cultivation

Adoption of all technologies in integrated manner is required to overcome the crisis of drought. Adoption index for these technologies ranged from 0 to 94 for different technologies (Fig. 1). Eventhough the farmers are having heavy water shortage none of the farmers have planted drought resistant mulberry plant varieties (Table 5). 8% of farmers have partial adoption in management of pruning schedule of mulberry garden. Only 18% of the farmers have full adoption of drip irrigation which was in conformity with the report of Krishnamoorthy and Radhakrishnan[2].

The soil moisture conservation technologies like trenching, mulching and green manuring have very low percent of adoption. The technology of Summer ploughing is adopted by 28 % of farmers. The rain water harvesting in mulberry garden also

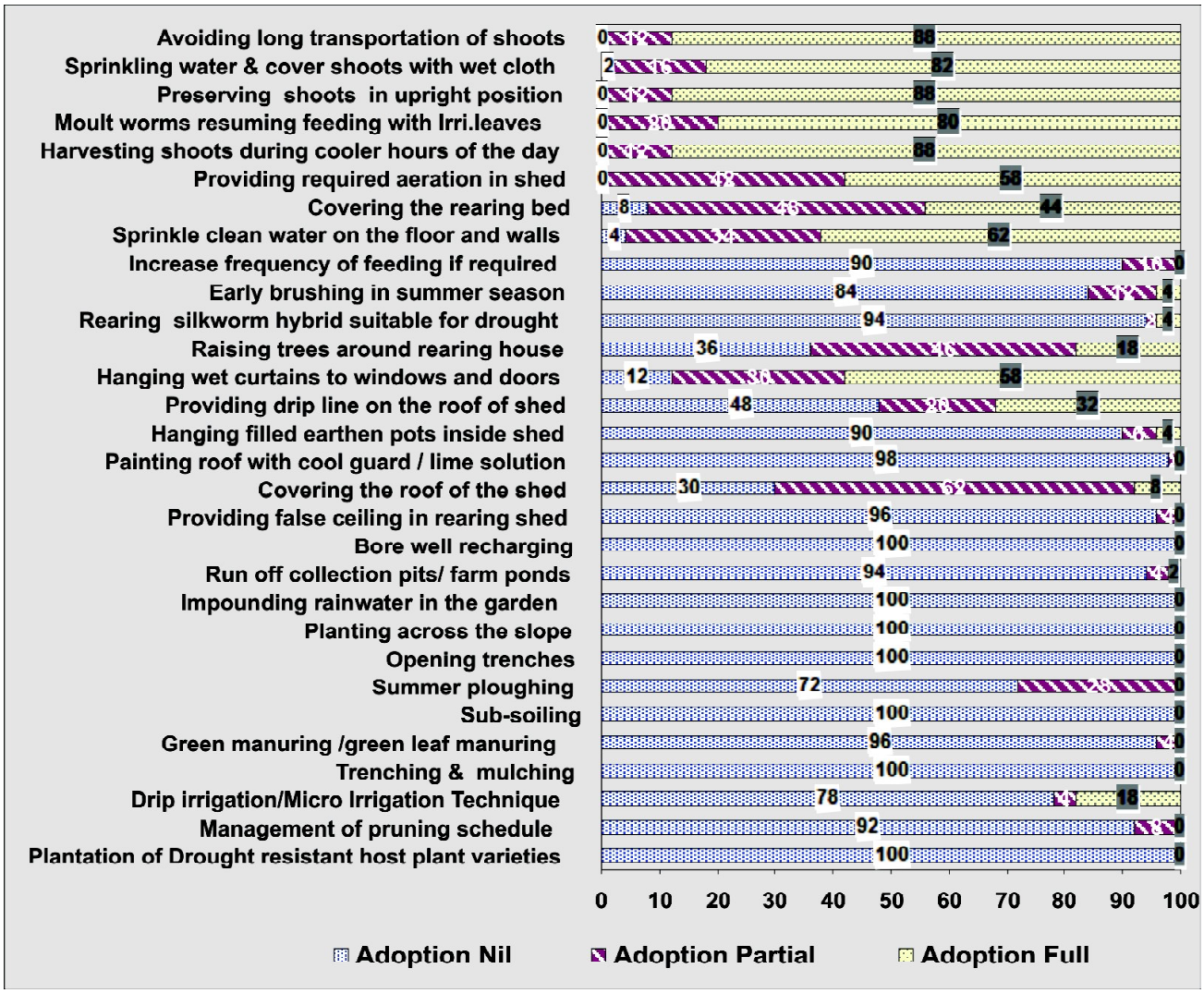

Figure 1: Extent of adoption of drought management technologies

have very low level of adoption. 94 to 100% of farmers have nil adoption of these technologies. Praveena *et al.* [8] reported that construction of farm ponds and other rain water harvesting structures should be encouraged in drought prone areas to mitigate water shortage. Production of quality mulberry leaves with moisture content is essential for sucessful silkworm rearing during summer months. Adoption of these technologies will increase the moisture holding capacity of the soil, prevent moisture loss and helps in production of quality mulberry leaves.

Drought management technologies in silkworm rearing

The silkworm rearing shed is very important for maintaining required temperature and humidity for the healthy growth of silkworms. Silkworm are more prone to diseases during hot and dry climate which prevails during drought period. Hence the technologies should be followed in an integrated manner to harvest sucessful silkworm crops. The important technologies in rearing shed such as false ceiling inside the rearing house, covering the roof, painting with cool guard, hanging water filled

earthen pots, providing dripline on roof, raising trees around rearing house have very low adoption ranging from 3 to 20%. Hanging wet curtains to increase the humidity is having 76% of adoption. The low level of adoption leads to inferior quality of cocoons in these seasons. 82 percent of farmers have nil adoption of rearing drought tolerant silkworm hybrids and 48% of have no adoption of early brushing of silkworm eggs. Only 21% of farmers have full level of adoption on increasing the feeding times during drought months. 36% of farmers have nil adoption of covering the leaves after feeding in drought period. The harvesting of mulberry leaves, transportation of harvested leaves and preservation of shoots have 70 - 100% of adoption. Higher adoption of these technologies in rearing is reported by Meenal and Rajan, [6].

Table 5
Technology wise extent of Adoption by the farmers

Sl.No	*Technologies*	*Extent of adoption (%)*			*Adoption Score*	*Adoption Index*
		Nil	*Partial*	*Full*		
1	Plantation of Drought resistant host plant varieties	100	0	0	0	0
2	Management of pruning schedule	92	8	0	4	4
3	Drip irrigation/Micro Irrigation Technique	78	4	18	20	20
4	Trenching & mulching	100	0	0	0	0
5	Green manuring /green leaf manuring	96	4	0	2	2
6	Sub-soiling	100	0	0	0	0
7	Summer ploughing	72	28	0	14	14
8	Opening trenches	100	0	0	0	0
9	Planting across the slope	100	0	0	0	0
10	Impounding rainwater in the garden	100	0	0	0	0
11	Run off collection pits/ farm ponds	94	4	2	4	4
12	Bore well recharging	100	0	0	0	0
13	Providing false ceiling in rearing shed	96	4	0	2	2
14	Covering the roof of the shed	30	62	8	39	39
15	Painting roof with cool guard / lime solution	98	2	0	1	1
16	Hanging filled earthen pots inside shed	90	6	4	7	7
17	Providing drip line on the roof of shed	48	20	32	42	42
18	Hanging wet curtains to windows and doors of shed	12	30	58	73	73
19	Raising trees around rearing house	36	46	18	39	39
20	Awareness rearing silkworm hybrid suitable for drought	94	2	4	5	5
21	Early brushing in summer season	84	12	4	10	10
22	Increase frequency of feeding if required	90	10	0	5	5
23	Sprinkle clean water on the floor and walls	4	34	62	79	79
24	Covering the rearing bed	8	48	44	68	68
25	Providing required aeration in shed	0	42	58	79	79
26	Harvesting shoots during cooler hours of the day	0	12	88	94	94
27	feeding Chawki& moult resuming worms with shoots from irrigated garden	0	20	80	90	90
28	Preserving shoots in upright position	0	12	88	94	94
29	Sprinkling water & cover shoots with wet cloth	2	16	82	90	90
30	Avoiding long transportation of shoots	0	12	88	94	94

CONCLUSION

The sericulturists of scarce rainfall zones of Andhra Pradesh are 21years of mean experience. Sericulture is the major source of income to them. Frquent droughts affected the mulberry cultivation and silkworm rearing quantitatively and quanlitatively. The problems faced by them during drought can be solved by adopting all drought management practices in integrated manner. The soil moisture conservation technologies like trenching, mulching and green manuring have very low percent of adoption. The technology of Summer ploughing and rain water harvesting in mulberry garden also have very low level of adoption. The important technologies in rearing shed such as false ceiling inside the rearing house, covering the roof, painting with cool guard, hanging water filled earthen pots, providing dripline on roof, raising trees around rearing house have very low adoption. The harvesting of mulberry leaves, transportation of harvested leaves and preservation of shoots have good percent of adoption. Silkworms are more prone to diseases during hot and dry climate which prevails during drought period. Hence the technologies should be followed in an integrated manner to harvest sucessful silkworm crops. Extension communication programmes are to be conducted to increase the awareness among farmers.

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