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RESEARCH ARTICLE

A Long-Term Statistical Dew Data Analysis For Coimbatore, Tamil Nadu

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ABSTRACT

Due to global warming, a drying and warming trend has been observed over the last 30 years in Tamil Nadu, India, which could significantly affect the condensation of vapor in surfaces. The seasonal (October to February) dew events for the year 1998-99 recorded the highest (86) while 2019-20 registered the lowest (34) value which might be due to obstructed cloud cover that have resulted in warmer nights prevailed in the region. The monthly dew deposition was found to be higher during October and November where the value of 0.21mm and 0.27mm was realized. The Mann- Kendal test revealed that during the months of December, January and February decrease in dew deposition was observed at the rate of -1.8mm (significant at 1 per cent level), -2.8 mm (significant at 10 per cent level) and -2.2 mm (significant at 5 per cent level) . Interestingly, during may month, the dew deposition showed an increase in trend of 1.8 mm (significant at 1 per cent level) for Coimbatore district of Tamil Nadu.

Keywords: *Dew events, Dew deposition, Climate Change, Dew*

INTRODUCTION

Dew is a major contribution of non-rainfall water (NRW) to ecosystem processes in dry and semi-arid locations, and it is likely to be altered by climate change. Commonly, dew deposits occur at night when the humidity is high and the temperature is relatively low. As the air next to the leaf's cools to its dew point and the surfaces of the leaves become colder than the surrounding air, water will condense on those surfaces (Nobel, 2009). The amount of dewfall has been reported under different climatic conditions. Dewfall of 0.086 mm day^{-1} was obtained with large dew collectors in India as reported by Sharan *et al*. 2007, and dewfall in tropical and Mediterranean climates was recorded at 0.10 - 0.17 mm day^{-1}, respectively (Clus *et al.,* 2008).

Severini *et al*. (1984) envisioned the daily production process of dew on grass by fusing common micrometeorological observations with the energy-balance equation in order to efficiently quantify the processes of dew creation. Beysens (1995) examined the process of dew formation and proposed that dew can be influenced by two essential factors: the substrate's wetting characteristics and temperature.

Numerous research has revealed that low air temperature (Pan *et al*., 2010), high relative humidity (Ye *et al*., 2006, Fang *et al*., 2015), and moderate wind speed (Beyens, 2016) were the ideal climatic conditions for the development of dew. However, more study is required to quantify the relevant components and understand the mechanism by which dew forms.

Dew formation is a common meteorological and hydrological occurrence that can be a valuable supply of water in rice fields, as well as carrying nutrients that help rice bloom (Singh *et al*., 2006). As dew condenses on leaves, it transfers nutrients that aid paddy development (Wen *et al*., 2012, Xu *et al.,* 2013). Dew can also help to dissolve leaf fertilizers and insecticides, allowing for better absorption through the leaf tissue (Jacobs *et al*., 2008). Furthermore, certain fungi and pests might consume part of the nutrients

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contained in the dew (Schuh *et al.,* 1993). Therefore, an attempt was made to assess the extent of dew accumulation and explore the possible agronomic exploitation trends in the future

MATERIAL AND METHODS

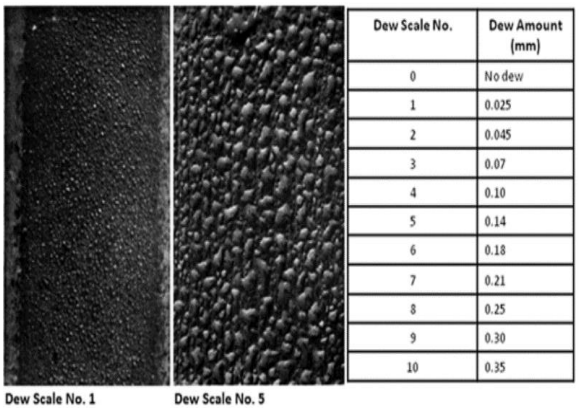
Dew Deposition and Dew Events

Daily dew accumulation data of 30 years (1991-92 to 2020-21) from October to February were collected from the Agro-Meteorological observatory, Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore (11ºN, 77ºE with 427 m above mean sea level) at four height levels viz. 5, 25, 50 and 100 cm each above the ground surface using Duvdevani dew gauge (Duvdevani, 1947). The dew deposited on wooden planks at four different heights was compared with dew album and recorded the amount of dew deposition (Fig 1). The descriptive statistical analysis was used to determine the minimum, maximum, mean, Standard Deviation (SD), Coefficient of Dispersion (CD) and Coefficient of Variation (CV) of dew deposition and dew events. The degree of variability was followed based on Panda and Sahu, 2019 such as low (CV < 20 per cent), moderate (20 < CV < 30 per cent), high (CV > 30 per cent), very high (CV > 40 per cent) and extremely high (CV > 70 per cent). Mann-Kendall Test (non-parametric) was applied to detect trend magnitude of dew deposition using Trend change detection software from October to February for the period of 1991-2021 in Coimbatore district, Tamil Nadu.

RESULTS AND DISCUSSION

Characteristics of dew events and dew deposition (Oct – Feb)

The dew events for the year 1998-99 recorded the highest (86) and the year 2019-20 registered the lowest (34) value while the dew deposition for the year 2007-08 recorded the highest (32.2 mm) and 2019-20 registered the lowest (7.0 mm) for the period of October to February Fig. 2). The Co-efficient of Variation (CV) for the dew events was 47.10 whilst the Co-efficient of Dispersion (CD) was 2.89. The CV and CD for the dew deposition was found to be 20.21 and 2.15 (Table 1). According to Jacobs (1999), Karl Pearson's correlation (r) value was found to be 0.745 between dew events and dew deposition which indicates that both had a strong positive linear relationship (Table 2).



Dew Scale No.	Dew Amount (mm)
0	No dew
1	0.025
2	0.045
3	0.07
4	0.10
5	0.14
6	0.18
7	0.21
8	0.25
9	0.30
10	0.35

Fig 1. Dew scale photographs for the Duvdenvani dew gauge and the scale for converting to dew amount

Though the statistical measures indicated the dependability of dew event and dew deposition was higher for the period of October to February, the rate of dew events and dew deposition were observed to be reduced in the recent past (Fig. 2). Higher minimum temperature would result in an increase of evaporation with a consequence of reduced dew precipitation. The

Table 1. Statistical summary of seasonal (Oct. to Feb.) dew events and dew deposition amounts from 1991-92 to 2020-21

Year (Oct to Feb)	Dew Events	Dew amount (mm)
Mean	14	54.6
SD	6.36	11.03
CV	47.10	20.21
CD	2.89	2.15

Table 2. Karl Pearson Correlation between dew deposition amount and dew events

Correlation	Dew amount	Dew events
Dew amount	1	
Dew events	0.745	1

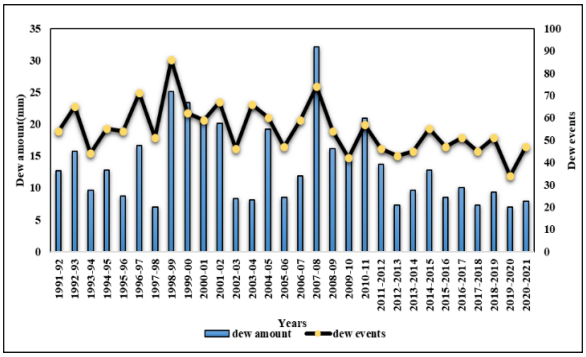


Fig. 2. Dew amounts and dew events (Oct. to Feb.) at Coimbatore

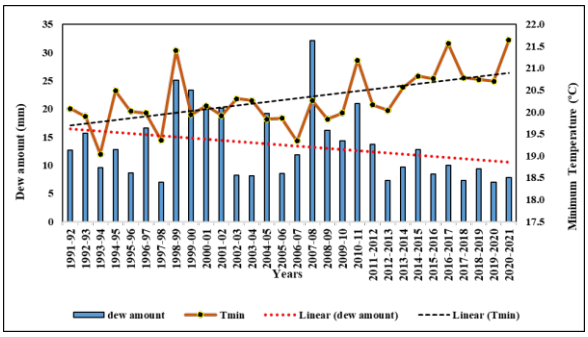


Fig. 3. Trend between Dew deposition and Minimum temperature

Table 3. Monthly trend analysis – Mann-Kendal Test on dew deposition in Coimbatore

Month	Z_c value	P value (α=0.05)	Result
October	-2.42	0.015	Non-Significant
November	-1.17	0.244	Significant
December	-2.74	0.006	Non-Significant
January	-1.28	0.202	Significant
February	-6.04	0.000	Non-Significant

results from Table 3 also affirmed that a decreasing trend was observed during October to February (significant decrease noticed during November and January) for the study period from 1991- 2021.

The minimum temperature data for the period of October to February at Coimbatore was found to exhibit an increasing trend while the dew deposition showed a decreasing trend which might be due to obstructed cloud cover that have resulted in warmer nights prevailed in the region (Fig. 3). A similar line of findings was reported by Mileta *et al.* 2007, Sharan *et al.* 2011 and Yokoyama *et al.* 2021.

CONCLUSION

The timing and duration of dewfall may play a more critical role than the total amount. The results indicated no notable significance of dew deposition for the planning of crop cultivation in the present era of climate change, especially under rainfed conditions. The seasonal (October to February) dew events for the year 1998-99 recorded the highest (86) while 2019-20 registered the lowest (34) value which might be due to obstructed cloud cover that have resulted in warmer nights prevailed in the region. The monthly dew deposition was found to be higher during October and November where the value of 0.21mm and 0.27mm was realized. The timing and duration of dewfall may play a more critical role than the total amount of dew deposition which may indirectly invites the pathogen infestation in the standing crops.

Ethics statement

No specific permits were required for the described field studies because no human or animal subjects were involved in this research.

Originality and plagiarism

We ensure that we have written and submitted only entirely original works.

Consent for publication

All the authors agreed to publish the content.

Competing interests

There was no conflict of interest in the publication of this content

Data availability

All the data of this manuscript are included in the MS.

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