

## Original Research Article

### **Study on long term trend analysis on occurrence of dew at Raipur**

#### **Abstract**

The present study on long term trend analysis on occurrence of dew was conducted during the 2022 year for long term data analysis of dew for the period 1991-2020 recorded at the Agro- meteorological Observatory, Research Area of Department of Agricultural Meteorology, Indira Gandhi krishi Vishwavidyalaya, Raipur, India. Based on study, daily dew observations were taken and converted into monthly and yearly dew observations. From the study, it was observed that there was significant decrease in dew amounts during the month of October, November and December. In addition to it, dew days of December month were found to be significantly decreasing. In yearly observation dew days found non-significant change and dew amount was found to be significantly decreasing.

**Keywords:** Dew, Agro-meteorology, dew point temperature, relative humidity, climate.

#### **1. INTRODUCTION**

Dew is a condensation in to liquid droplets of water vapour on substrate. The presence of a substrate is the origin of the peculiarities and richness of the phenomenon. When the moisture is deposited in the form of water droplets on cooler surfaces of solid objects (rather than nuclei in air above the surface) such as stones, grass blades and plant leaves, it is known as dew. The ideal conditions for its formation are clear sky, calm air, high relative humidity and cold and long nights. For the formation of dew, it is necessary that the dew point is above the freezing point. Most objects, including grass blades, leaves and petals, are much better radiators than air. As a result, they are usually colder at night than is the air. The cold surface cools the air in its vicinity and, if the air contains sufficient atmospheric humidity, it may cool below its dew point. When this happens, water vapour will condense out of the air onto the surface. The formation of dew is a common and natural process in which water vapour in the air condenses on a cooler substrate and transforms into liquid water. Dew is an important source of water that may significantly influence the physiological status of vegetation and the

microclimate environment. Although the yield is relatively small, dew itself as a viable water resource which occurs naturally and frequently in many locations globally, particularly in arid and semi-arid areas and during dry periods in humid areas.

Global climate change is significantly altering various environmental variables in many countries around the world. This situation could have important effects that seriously threaten populations as well as agriculture, environment, economy and industry. Atmospheric water vapour is one of the most important factors in determining the Earth's weather and climate because of its role as a greenhouse gas as well as the large amounts of energy involved in changing water from liquid and solid phases to the gaseous (vapour) phase. As an indicator of water vapour levels in the air, relative humidity (RH) directly affects atmospheric visibility and strongly influences the formation of clouds, fog and dew. Three sources of water are involved in dew formation in an ecosystem. The dominant one is water vapour in the lower atmosphere (dewfall). The second one originates from the flooded soil (dew rise). The last one is the guttation which is the loss of water and dissolved materials from uninjured plant organs. Direct condensation of atmospheric water vapour brings a net gain of water to the soil-plant-water system compared to guttation from leaves and distillation of soil water.

Meteorological factors which affect dew formations are relative humidity, wind speed and temperature. Dew formation is favored by (i) a relative humidity at sunset of at least 75 percent (ii) wind speed less than 3 m/s and (iii) clear skies. Similarly, fog is nothing but cloud at ground level condensation of invisible water vapor in air into visible droplets of water and is provoked by the weather conditions (i) substantial heating during day time (ii) clear skies or very light, high clouds at night (iii) no or very light wind (iv) a thermal inversion at moderate height and (v) a sufficiently high atmospheric humidity (Singh, 2017). Relative Humidity (RH) is the amount of moisture in the air as a percentage of the maximum amount of moisture that the air could hold at the same temperature also known as the saturation point. Due to its direct relationship to fluctuating temperature, RH alone doesn't provide enough information on how much moisture is in the air. As air gets warmer, it can hold more moisture. As a result if air temperature increases and the amount of moisture in the air stays the same, the RH will fall. The opposite is also true – if temperature falls and the amount of moisture in the air stays the same, the RH will rise. In both of these examples of changing RH there would be no change in the Dew Point, because the quantity of moisture in the air remains the same. An increase or decrease in Dew Point temperature happens when the actual quantity of moisture

in the air changes. As a result, compared to the RH, the Dew Point temperature is relatively constant and changes in dew Point temperature are caused by weather systems. The wind speed is a key factor for dew formation. However, the function of wind for dew deposit is complicated. Although the strong wind enhances the heat exchange, this situation may homogenize the temperature quickly and decrease the temperature down below the dew point temperature. Recent findings on dew deposition on plant water relations and diurnal variations of photosynthesis in plants found that the leaves were able to absorb dew and thus restore plants water status (Munne-Bosch and Alegre, 1999). Therefore, keeping in view the significance of these weather parameters, an attempt has been made here to study the dew parameter for sustainable agricultural development.

## **2. STUDY AND METHODOLOGY**

The dew data were taken from the Indian Meteorological Department recorded at the Agro meteorological Observatory Research Area of Department of Agricultural Meteorology, Indira Gandhi krishi Vishwavidyalaya, Raipur, India. The dew observations were taken at height of 5cm, 25 cm, 50 cm and 100cm from ground level respectively. Systematic weather record of dew measurement was taken during the months (September to April) for the period 1991 to 2020 of Raipur and data have been considered for this study. The data series was so chosen because the rise in global temperature and climatic variability during these years was faster than in any other period (Anonymous, 2000) and maximum climatic variation had been reported during the recent decade.

## **3. RESULTS AND DISCUSSIONS**

### **3.1 Monthly dew data analysis**

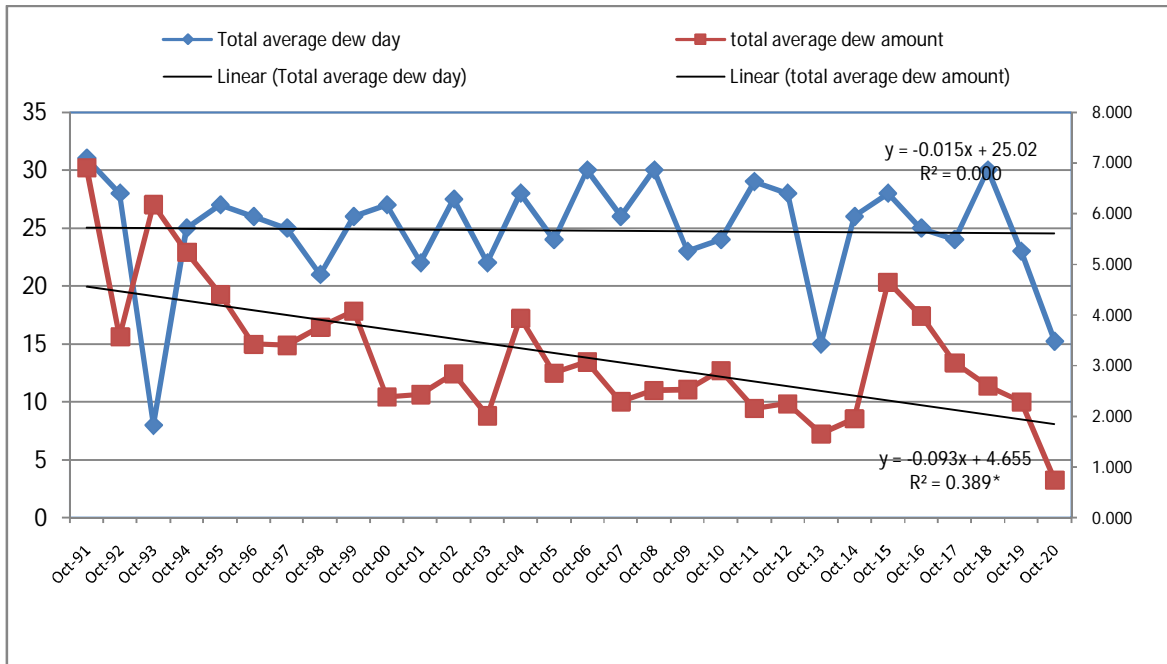
The observations on dew recorded at the Agro meteorological Observatory during the months have been mentioned in **Table 1** during the period of 1991-2020. It was analyzed that there was significant decrease in dew amount during the month of October and November at the rate of 0.093 mm and 0.132 mm per year, respectively. The total average dew days of October month was found to be decreasing while for November month, average dew days were found to be increasing, whereas both dew average day and dew amount was found to be significantly decreasing at the rate of 0.158 mm in December month. The trend analysis of total average dew days and total average dew amount of October, November and December

month was found to be significant. Therefore, the monthly data of these months are graphically depicted in Fig 1, Fig 2 and Fig 3 respectively.

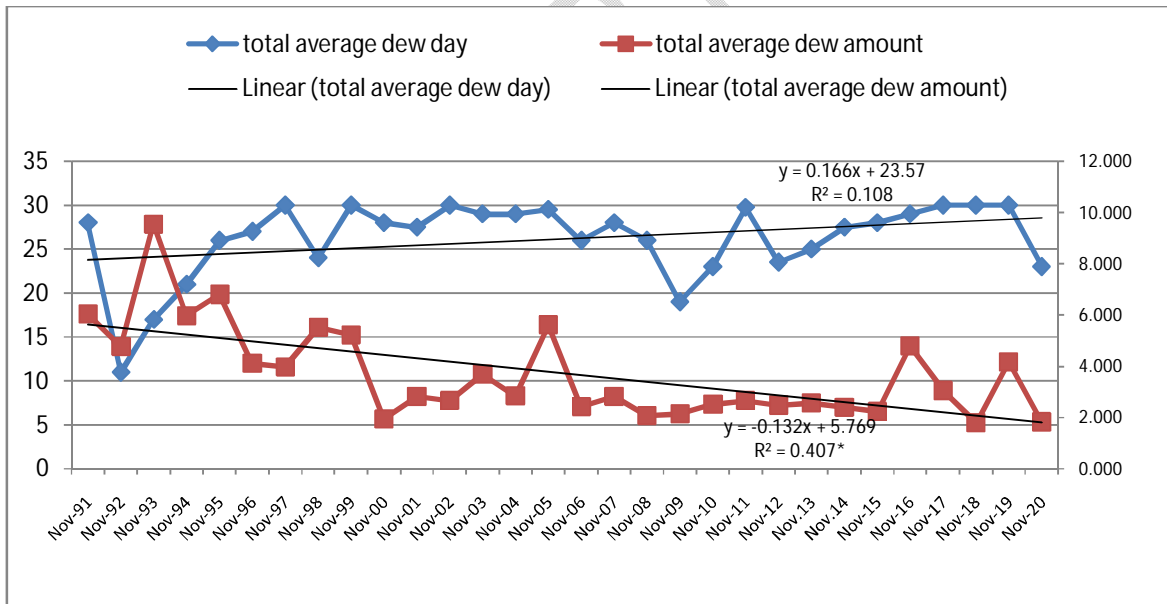
In many parts of the world, dew formation on plants is a common occurrence (Garratt and Segal, 1988). During monthly dew analysis for other months, it was observed that there was no significant increase or decrease was recorded. It was seen that for January month there is decrease in total average dew days and total average dew amount at the rate of 0.023 mm. For February month total average dew days were found to be decreasing whereas total average dew amount was seen increasing by 0.005 mm per year, but result observed for both were not significant. It was noted that for March month there is increase in total average dew days and total average dew amount by 0.011 mm but it was also not significant. From the below Table-1, it can be declared that the total dew average day and total average dew amount of April month was found to be increasing and decreasing, respectively but found to be non-significant. On the contrary, it was noticed that for September month, both total average dew days and total average dew amount decreased by 0.017 mm per year at non-significant pattern.

**Table 1: Monthly dew data analysis (1991-2020)**

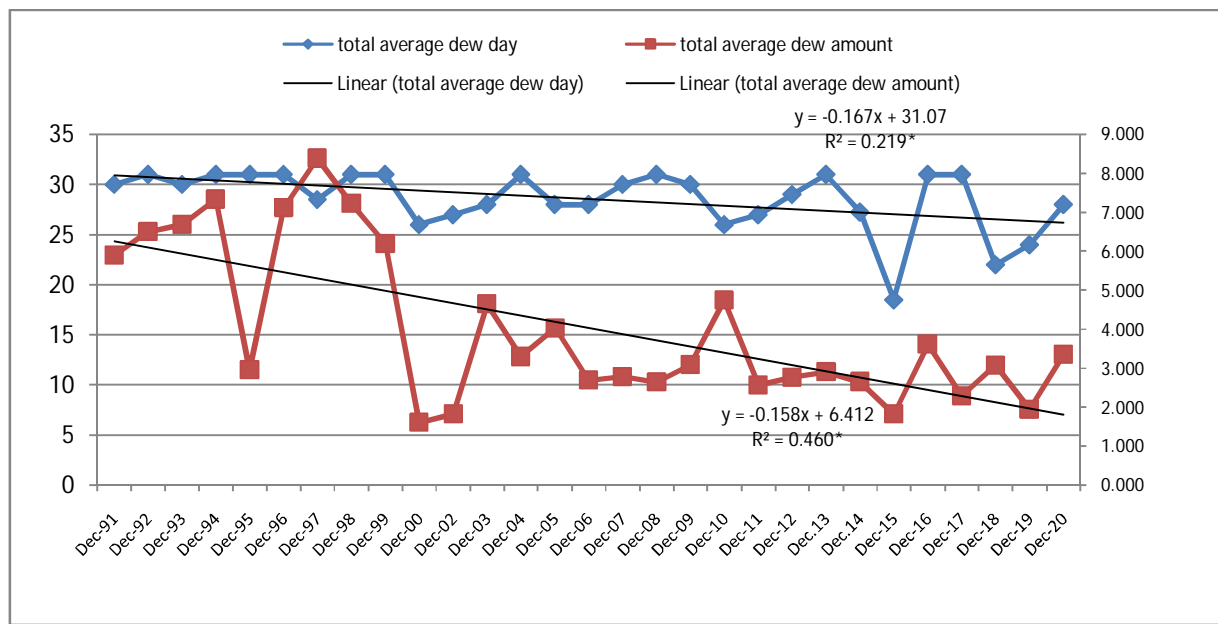
Monthly data	Total dew average day	R <sup>2</sup>	Total average dew amount	dew R <sup>2</sup>
January	$y = -0.101x + 27.96$	0.055	$y = -0.023x + 2.607$	0.047
February	$y = -0.109x + 19.01$	0.018	$y = 0.005x + 1.048$	0.002
March	$y = 0.112x + 3.655$	0.024	$y = 0.011x + 0.151$	0.058
April	$y = 0.012x + 0.173$	0.011	$y = -0.000x + 0.013$	0.002
September	$y = -0.087x + 15.07$	0.019	$y = -0.017x + 1.242$	0.115
October	$y = -0.015x + 25.02$	0.00	$y = -0.093x + 4.655$	<b>0.389*</b>
November	$y = 0.166x + 23.57$	0.108	$y = -0.132x + 5.769$	<b>0.407*</b>
December	$y = -0.167x + 31.07$	<b>0.219*</b>	$y = -0.158x + 6.412$	<b>0.460*</b>



**Fig 1: Trend analysis of total average dew days and total average dew amount of October month**



**Fig 2: Trend analysis of total average dew day and total average dew amount of November month**



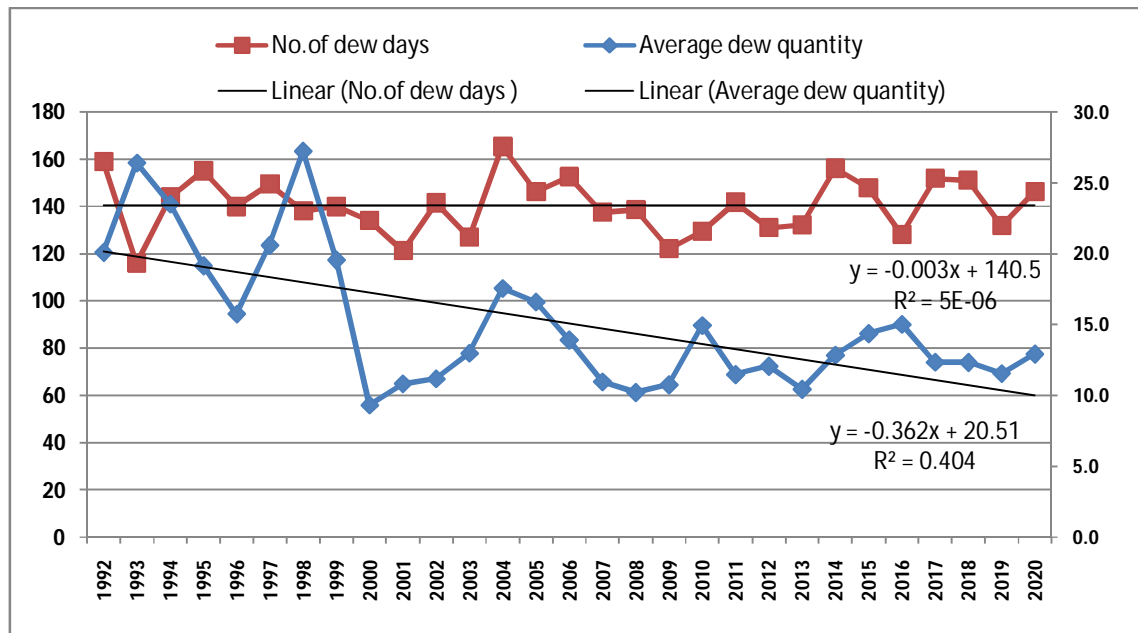
**Fig 3: Trend analysis of total average dew day and total average dew amount of December month**

### 3.2 Yearly dew data analysis

The observations on dew recorded at the Agro meteorological Observatory during the period of 1991-2020 have been tabulated in Table no. 2 and graphically represented in Fig no. 4. According to the data it was analysed that yearly total average dew days found non-significant change and total average dew amount was found to be decreasing significantly at the rate of 0.362 mm per year.

**Table 2: Yearly dew data analysis (1991-2020)**

Yearly data	Total average dew day	R <sup>2</sup>	Total average dew amount	R <sup>2</sup>
1991-2020	$y = -0.003x + 140.5$	0.00	$y = -0.362x + 20.51$ $R^2 = 0.404$	<b>0.404*</b>



**Fig 4: Yearly Trend analysis of total average dew day and total average dew amount**

#### 4. Conclusion

Under specific environmental conditions dew can be captured and may yield substantial amounts of water which can be used for domestic purposes, livestock, and establishment of trees or for the growth of crops to achieve the objective of alternate source of water. From the study, it can be concluded that long term analysis of monthly dew data (1991-2020) was observed constantly decreasing as we observed for October, November and December month. In these months both total average dew days and total average dew amount was found to significantly decreasing. Therefore, yearly dew data also found to be significantly decreasing over the years. The result obtained may be due high climatic fluctuations in weather parameters like increase in global warming, green house effect which caused increase in temperature which affect other parameters like rainfall, relative humidity, dew and many other. The impact of dew on agricultural crops for growth and development, inputs from various specialized disciplines and

allied sciences engaged in meteorological applications along with forecasting skills from non scientific quarters are needed to predict the weather parameter accurately (Singh *et al.*, 2004), thus the active cooperation between meteorological /remote sensing agencies, agricultural organizations and farming community is needed.

## 5. References

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