# DUSTFALL AT JODHPUR—PART III

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Dustfall collections were continued for 1964 and 1965, in large aluminium pans. In 1965, the newly designed apparatus called "Dustfall Collector" was used in addition. The atmospheric deposits occurring during the period of storm and high wind were separately collected for each year. The water insolubles and water solubles were determined. The ionic constituents $CO_3^{--}$, $HCO_3^-$, $Cl^-$, $Ca^{++}$ and $Mg^{++}$ were determined in 1964 monthly samples; in 1965, $NO_2^-$, $NO_3^-$, $Na^+$ and $K^+$ were determined in addition. The ionic constituents $HCO_3^-$, $Cl^-$, $Ca^{++}$ and $Mg^{++}$ were determined in the storm/high wind samples of 1965. $SO_4^{--}$ and $CO_3^{--}$ ions were found absent in all samples except that $CO_3^{--}$ was present in only June and July samples of 1964.

Atmospheric dustfall occurring during two years 1962 and 1963 were measured at Jodhpur by means of a Deposit Gauge made according to British Standard Specification and a Glass Trough partially filled with distilled water[1]. Of these two apparatuses, the Glass Trough was found to have always collected more atmospheric deposits than the Deposit Gauge. Studies were therefore further made on the design and development of dustfall collectors as a result of which a standard "Dustfall Collector" suitable for use in the desert areas of Rajasthan was finally adopted and manufactured and set at nine different sites of Western Rajasthan[2] in the year 1965.

During the two years, 1964 and 1965, the dustfall collections were made in large aluminium pans with a view to have a rather greater amount of deposits. In 1965, the newly designed dustfall collector was regularly used in addition.

The present paper gives the amount of dustfall that occurred at Jodhpur during each of the years 1964 and 1965. The dustfall occurring during the periods of storm and high wind was separately collected.

The water insolubles were determined and from the water solubles, the main ions present in the extract were determined. These studies give an idea about the quantity of ionic constituents and insoluble materials collected from the atmosphere at Jodhpur during the two years 1964 and 1965.

This investigation is a part of the long term programme of studies on the dustfall at Jodhpur commenced in June 1961. The object of this part of the study was to collect larger amounts of atmospheric deposits in order to facilitate quantitative chemical analysis and obtain data with the standard Dustfall Collector. It was also the object to obtain further data for the annual transport of water soluble ions along with the dustfall.

## EXPERIMENTAL PROCEDURE

*Apparatus*

(*i*) Aluminium pan, circular (dia = 122 cm; depth = 25·4 cm) fabricated from INDAL 3 sheet, 3 mm thick.

(*ii*) Dustfall Collector (dia of collecting bowl = 30 cm)

(*iii*) Glass Trough (dia = 30 cm).

*Materials*

Atmospheric deposits collected in 1964 and 1965 :

(*a*) Monthly

(*b*) During storm and high winds.

*Site*

Open exposure yard, Defence Laboratory, Jodhpur.

*Method*

Two aluminium pans were used in 1964 as well as in 1965. One was exposed dry and the other was kept about one-third filled with distilled water. In addition, the Dustfall Collector was used in 1965.

The aluminium pans were placed at an elevated support so that the rim was at a height of one metre from the ground. The Dustfall Collector was also at a height of one metre and contained distilled water.

The dustfall was collected during the following periods:

(*i*) Monthly (30±1 day)

(*ii*) During storm and high wind.

In 1964, the dustfall occurring during storm and high wind periods was collected in dry aluminium pan. The use of dry pan had to be made due to extreme shortage of distilled water. As water is useful in arresting dustfall, a Glass Trough (dia 30 cm) in lieu of the dry aluminium pan, partially filled with distilled water, was exposed in 1965 during the storm periods. The Glass Trough proved to be convenient for quick handling on the onset of storm.

All results have been expressed in terms of metric tons per sq km surface.

*Monthly samples*—The monthly dustfall was collected at the end of each month (30±1 day). The water soluble (WS) portions were extracted from the dustfall. The water insolubles (WI), after drying at 110°C, were weighed. The sum of water solubles and insolubles constituted the total dustfall.

The water solubles were examined with respect to the wet aluminium pans for 1964 and 1965 and also for the Dustfall Collector. *pH*, conductivity, and the ionic constituents $CO_3--$, $HCO_3-$, $Cl-$, $NO_2-$, $NO_3-$, $SO_4--$, $Ca++$, $Mg++$, $Na+$ $K+$ and boron were determined. The $NO_2-$, $NO_3-$, $Na+$ and $K+$ ions were determined only for the year 1965.

The determination of ions was made according to standard methods[3]. $Ca++$ and $Mg++$ were determined by EDTA method. $NO_2-$, $NO_3-$ and boron were determined by colorimetric methods. The $SO_4--$ ion was determined by the turbidimetric method[4] and found to be always absent.

*Storm high wind samples*—The study on the dustfall occurring storm and high wind in 1965 was conducted in a way similar to that of monthly samples. Except the collection of dustfall and determination of the total amount of water solubles, no further chemical analysis was made with the 1964 samples.

*Mechanical analysis*—(*a*) Monthly samples : Feb–July, 1964—mechanical analysis of the dustfall collected by the dry pan and the water insolubles obtained from the wet pan was made for the months February to July, 1964. Only the average values of particle size were determined. No mechanical analysis for 1965 samples was carried out. (*b*) Storm and high wind samples, 1965—mechanical analysis of the water insolubles for 1965 samples collected during storm and high wind was carried out by B.S. Sieves. Only average values of the particle size were determined. No mechanical analysis of 1964 samples collected during storm and high wind was carried out.

*Wind speed*—The mean values of the maximum wind speeds, at 08-30, 11-30, 14-30 and 17-30 hours for all the months of the years 1964 and 1965 were recorded by the Meteorological Division of the Defence Laboratory, Jodhpur, and are plotted in Fig 1.

It may be seen that though the average max wind speed in 1965 was higher than in 1964, the quantity of dustfall was in reverse order, *i e.* more in 1964. This was true of the annual fall as well as the fall during storm and high winds.

Lower dustfall in 1965 was due to earlier rains. In 1965, the rainfall was as 7·62 mm (Jan), 1·52 mm. (Feb) and 14·22 mm (March). In 1964, the rainfall started in May. The earlier rains in 1965, helped in retaining some of the dustfall particles which would otherwise have been borne out by the winds at the source of its origin.

## RESULTS AND DISCUSSION

### *Total dustfall, water solubles and insolubles*

(*i*) 1964

From Table 1 it may be seen that 992 metric tons of dustfall occurred over one sq km during the year 1964 as determined by the wet aluminium pan method. The dry aluminium pan recorded 623·4 metric tons during the period. The dry pan thus recorded 37·2% less dustfall than the wet pan method.

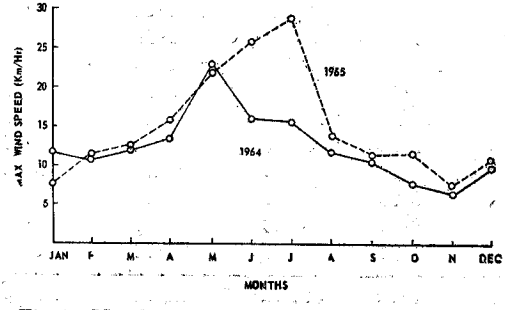


Fig 1—Monthly average of maximum wind speeds at Jodhpur during 1964 and 1965

The water solubles amounted to 20·5 metric tons over one sq km surface for the whole year which represents 2·07 per cent of the total dustfall by the wet pan. The water insolubles amounted to 971·5 metric tons by the wet pan.

TABLE 1

MONTHLY DUSTFALL AT JODHPUR DURING 1964

(metric tons/sq km)

WI—Water insolubles : WS—Water solubles

| Month | Aluminium Pan, dry (total dustfall) | Aluminium-Pan, wet | | |
|---|---|---|---|---|
| | | WI | WS | Total dustfall |
| Jan | 2·24 | 5·02 | 1·00* | 6·02 |
| Feb | 14·91 | 20·21 | 1·00* | 21·21 |
| Mar | 45·30 | 49·06 | 1·70* | 50·76 |
| April | 30·27 | 31·09 | 1·70* | 32·79 |
| May | 374·0 | 612·20 | 1·92 | 613·12 |
| June | 85·35 | 142·20 | 2·92 | 145·12 |
| July | 45·12 | 65·13 | 2·82 | 67·95 |
| Aug | 13·66 | 13·90 | 1·18 | 15·08 |
| Sept | 5·51 | 14·97 | 1·97 | 16·94 |
| Oct | 2·55 | 7·71 | 1·25 | 8·96 |
| Nov | 2·28 | 4·45 | 0·72 | 5·17 |
| Dec | 2·10 | 5·60 | 0·62 | 6·21 |
| Total : | 623·39 | 971·54 | 18·80 | 988·33 |

*Assumed values inserted. The values were taken to be similar to Jan, Feb, March and April values of the year 1965 for which such values are available by wet pan method vide Table 2.

TABLE 2

MONTHLY DUSTFALL AT JODHPUR DURING 1965

(metric tons/sq km)

WI—Water insolubles : WS—Water solubles

| Month | Aluminium-Pan, dry (total dustfall) | Aluminium-Pan wet | | | Dustfall collector | | |
|---|---|---|---|---|---|---|---|
| | | WI | SW | Total dustfall | WI | WS | Total dustfall |
| Jan | 2·67 | 4·36 | 1·06 | 5·42 | 2·55 | 1·41 | 3·96 |
| Feb | 4·84 | 12·52 | 1·06 | 13·58 | 5·03 | 2·99 | 8·02 |
| Mar | 39·61 | 57·10 | 1·87 | 58·97 | 25·10 | 1·98 | 27·08 |
| April | 14·17 | 42·32 | 1·64 | 43·96 | 21·79 | 1·77 | 23·56 |
| May | 35·97 | 102·90 | 2·08 | 104·98 | 66·26 | 6·38 | 72·64 |
| June | 52·27 | 116·20 | 1·24 | 117·44 | 64·11 | 2·50 | 66·61 |
| July | 69·56 | 202·70 | 7·54 | 210·24 | 133·80 | 8·21 | 142·01 |
| Aug | 7·91 | 20·48 | 2·64 | 23·12 | 32·19 | 5·69 | 37·84 |
| Sept | 3·49 | 6·20 | 2·16 | 8·36 | 8·06 | 1·24 | 9·30 |
| Oct | 2·16 | 5·93 | 0·82 | 6·75 | 5·91 | 3·16 | 9·07 |
| Nov | 2·10 | 5·84 | 0·72 | 6·56 | 4·53 | 1·53 | 6·06 |
| Dec | 1·81 | 5·76 | 0·58 | 6·34 | 5·29 | 1·18 | 6·47 |
| Total : | 235·90 | 582·31 | 23·41 | 605·72 | 374·62 | 38·00 | 412·62 |

(*ii*) 1965

(*a*) *By wet pan*

From Table 2, it may be seen that 605·7 metric tons of dustfall occurred during 1965 over one sq km area according to wet aluminium pan method. The dry aluminium pan recorded a fall of 235·9 metric tons during this period. The dry pan thus recorded 61% less dustfall than the wet aluminium pan method.

The water solubles amounted to 23·4 metric tons over one sq km surface for the whole year which represents 3·86% of the total dustfall by the wet pan. The water insolubles amounted to 582·3 metric tons by the wet pan.

(*b*) *By dustfall collector*

In 1965, the newly designed dustfall collector was set up. The total dustfall recorded by this collector amounted to 412·6 metric tons which is 31·9% less than that recorded by the wet pan in 1965.

The water solubles by the Dustfall Collector amounted to 38 metric tons which represents 9·3% of the total dustfall collected by it.

A comparison of the 1964 and 1965 dustfalls, as recorded by the wet pan, shows that 38·9% less dustfall had occurred in 1965 than in 1964.

The results show that dustfall varies from year to year and so also the percentage water solubles. The quantity of dustfall collected depends on the design of the collector and its surface area. It points to the need and desirability of collecting dustfall by means of a standard collector so that all results can be compared.

The dry pan, it may be noted, has collected less dustfall than the corresponding wet pan for both 1964 and 1965. The lesser collections are due to two factors: (*i*) the dustfall does not completely deposit as there is no arrester and (*ii*) fraction of the deposits may be borne away subsequent to its deposit by a later high wind or storm. An arrester like water increases the quantity of deposit.

*Transport of dustfall during 4 months* (*April–July*) 1964 *and* 1965.

During the 4 months April–July, 86·6% of the total annual dustfall was collected in 1964 by the wet pan method. During the same period in 1965, 78·5% and 73·7% of the dustfall was collected respectively by the wet pan and Dustfall Collector.

*Annual ionic transport*

The soluble portions of the salts that are borne away along with the dustfall can be determined from the aqueous extract of the dustfall. The ionic constituents were determined for each month's dustfall collection made by the wet pan [1964 (May–Dec) and (1965)] and the Dustfall Collector (1965). Thus the total quantities for the year can be easily computed.

A comparison of the total amount of ionic fall that occurred during the period May–Dec 1964 with those of May–Dec, 1965 as collected by the wet aluminium pan in each of these two years (see Tables 3 & 4), shows that in 1964, each of the bicarbonate,

TABLE 3

ANALYSIS OF WATER SOLUBLES OF MONTHLY DUSTFALL
JODHPUR 1964

(metric tons/sq km)

Type of collector—Aluminium-Pan (Wet)

| Month | *pH* | Conductivity at 25°C (micromhos /cm) | $CO_3^{--}$ | $HCO_3^{-}$ | $Cl^{-}$ | $Ca^{++}$ | $Mg^{++}$ | Boron |
|---|---|---|---|---|---|---|---|---|
| May | 7·88 | 494 | Nil | 0·603 | 0·173 | 0·229 | 0·043 | 0·002 |
| June | 8·22 | 452 | 0·082 | 1·096 | 0·218 | 0·335 | 0·024 | 0·002 |
| July | 8·22 | 494 | 0·046 | 0·956 | 0·305 | 0·273 | 0·045 | 0·002 |
| Aug | 7·54 | 221 | Nil | 1·179 | 0·019 | 0·335 | 0·033 | Trace |
| Sept | 7·40 | 263 | Nil | 1·586 | 0·079 | 0·266 | 0·098 | Trace |
| Oct | 7·40 | 231 | Nil | 0·720 | 0·054 | 0·260 | 0·024 | 0·001 |
| Nov | 7·24 | 136 | Nil | 0·475 | 0·019 | 0·157 | 0·024 | 0·001 |
| Dec | 7·62 | 179 | Nil | 0·367 | 0·015 | 0·191 | 0·016 | 0·001 |
| Total : | | | 0·128 | 6·982 | 0·882 | 2·046 | 0.307 | 0·009 |

TABLE 4

ANALYSIS OF WATER SOLUBLES OF MONTHLY DUSTFALL

JODHPUR 1965

(metric tons/sq km)

Type of collector—Aluminium-Pan (Wet)

| Month | *pH* | Conductivity (micromhos/cm at 25°C) | $HCO_3^{-}$ | $Cl^{-}$ | $NO_2^{-}$ | $NO_3^{-}$ | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | Boron |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 7·4 | 179 | 0·74 | 0·01 | Nil | Nil | 0·244 | 0·024 | 0·016 | 0·039 | 0·013 |
| Feb | 6·9 | 168 | 0·75 | 0·008 | Nil | 0·003 | 0·205 | 0·020 | 0·039 | 0·045 | Trace |
| Mar | 7·88 | 231 | 1·32 | 0·018 | Nil | 0·017 | 0·402 | 0·038 | 0·052 | 0·056 | Trace |
| April | 6·66 | 400 | 0·46 | 0·035 | Trace | 0·003 | 0·424 | 0·040 | 0·083 | 0·123 | Trace |
| May | 6·68 | 652 | 1·43 | 0·051 | 0·002 | 0·004 | 0·354 | 0·010 | 0·121 | 0·104 | Trace |
| June | 7·54 | 600 | 0·71 | 0·017 | Trace | Trace | 0·183 | 0·042 | 0·146 | 0·062 | 0·001 |
| July | 6·22 | 558 | 3·08 | 2·083 | Trace | Trace | 1·667 | 0·118 | 0·064 | 0·064 | 0·002 |
| Aug | 7·24 | 50·8 | 1·03 | 0·034 | Trace | 0·005 | 0·527 | 0·633 | 0·131 | 0·109 | Trace |
| Sept | 7·92 | 35·8 | 1·55 | 0·015 | Trace | 0·012 | 0·465 | 0·222 | 0·081 | 0·012 | Trace |
| Oct | 7·1 | 294·8 | 0·51 | 0·012 | 0·001 | 0·036 | 0·168 | 0·011 | 0·069 | 0·029 | Trace |
| Nov | 7·96 | 153·7 | 0·42 | 0·006 | Trace | Trace | 0·205 | 0·008 | 0·003 | 0·048 | Trace |
| Dec | 7·28 | 180 | 0·39 | 0·004 | 0·039 | 0·003 | 0·113 | 0·004 | 0·009 | 0·016 | Trace |
| Total : | | | 12·39 | 2·284 | 0·042 | 0·083 | 4·957 | 1·170 | 0·814 | 0·707 | |

chloride, calcium and magnesium ions deposited in less amount than in 1965 for the corresponding period. Presence of a small amount of carbonate was noted in June and July sample of 1964; this was completely absent in 1965 samples.

It is observed from Tables 4 & 5, that there are some variations in the amount of ionic fall from month to month between the values obtained by the wet aluminium pan (1965) and the Dustfall Collector (1965). Since both the apparatuses contained water, there was no loss of the materials once deposited, unlike the dry dust which can be partially borne away. The cause of such differences appears to lie with the wind pattern including its eddies and contents of ionic species and the design of the apparatus.

(*i*) 1964

The ionic constituents were determined for the months May–Dec in 1964. The quantities of ions that were deposited during this period of 8 months was found to be (Table 3) in terms of metric tons per sq km as 0·13 ($CO_3^{--}$), 6·98 ($HCO_3^{--}$), 0·88 ($Cl^-$), 2·04 ($Ca^{++}$), 0·31 ($Mg^{++}$), 0·009 (boron).

(*ii*) 1965

The amount of ions transported by the atmosphere and deposited along with the dustfall during the 12 months of 1965 were found to be in terms of metric tons per sq km as follows:

| | Wet pan | Dustfall collector |
|---|---|---|
| $CO_3^{--}$ | Nil | Nil |
| $HCO_3^-$ | 12·39 | 15·50 |
| $Cl^-$ | 2·29 | 2·68 |
| $NO_2^-$ | 0·003 | 0·055 |
| $NO_3^-$ | 0·083 | 0·041 |
| $Ca^{++}$ | 4·96 | 5·59 |
| $Mg^{++}$ | 1·17 | 1·41 |
| $Na^+$ | 0·81 | 1·26 |
| $K^+$ | 0·70 | 0·77 |
| Boron | trace | 0·11 |

*Transport of ions during 4 months (April–July, 1965)*

During the 4 months, April–July, 1965, the percentage of ions transported with reference to the total annual quantity amounted to 62·6% ($HCO_3^-$), 85·1% ($Cl^-$), 48·7% ($Ca^{++}$), 22·5% ($Mg^{++}$).

*Dustfall during storm and high wind*

(*i*) 1964 (*see Table* 6)

There were 37 days of storm and high wind in 1964 at Jodhpur which occurred only during the three months May–July. During these 37 days, 461·6 metric tons of dustfall

TABLE 5

ANALYSIS OF WATER SOLUBLES OF MONTHLY DUSTFALL

JODHPUR 1965

(metric tons/sq km)

Type of Collector—Dustfall Collector

| Month | *pH* | Conductivity (micromhos/cm at 25°C) | $HCO_3^-$ | $Cl^-$ | $NO_2^-$ | $NO_3^-$ | $Ca^{++}$ | $Mg^{++}$ | $Na^+$ | $K^+$ | Boron |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 6·82 | 347 | 0·48 | 0·035 | Trace | Trace | 0·113 | 0·027 | Trace | Trace | Trace |
| Feb | 7·40 | 505 | 0·66 | 0·028 | Trace | Trace | 0·158 | 0·056 | 0·035 | 0·032 | 0·032 |
| Mar | 8·0 | 842 | 1·04 | 0·028 | 0·001 | 0·007 | 0·362 | 0·041 | 0·070 | 0·047 | 0·004 |
| Apr | 7·74 | 113 | 0·58 | 0·021 | Trace | 0·006 | 0·801 | 0·031 | 0·021 | 0·010 | Trace |
| May | 6·86 | 172 | 4·76 | 0·170 | 0·001 | 0·003 | 0·531 | 0·075 | 0·157 | 0·091 | Trace |
| June | 7·68 | 208 | 1·59 | 0·277 | Trace | Trace | 0·409 | 0·065 | 0·219 | 0·095 | Trace |
| July | 6·60 | 695 | 2·77 | 1·816 | Trace | Trace | 0·981 | 0·147 | 0·113 | 0·042 | 0·008 |
| Aug | 7·48 | 107 | 1·70 | 0·308 | 0·001 | 0·011 | 0·416 | 0·558 | 0·476 | 0·255 | Trace |
| Sept | 7·76 | 33 | 0·56 | Trace | 0·007 | 0·017 | 0·186 | 0·244 | 0·038 | 0·077 | Trace |
| Oct | 7·34 | 80 | 0·38 | Trace | 0·003 | 0·055 | 1·059 | 0·111 | 0·076 | 0·038 | 0·069 |
| Nov | 7·08 | 47 | 0·86 | Trace | 0·042 | 0·042 | 0·305 | Trace | 0·035 | 0·031 | Trace |
| Dec | 7·04 | 42 | 0·12 | Trace | Trace | Trace | 0·267 | 0·058 | 0·022 | 0·050 | Trace |
| Total | | | 15·50 | 2·683 | 0·055 | 0·141 | 5·588 | 1·413 | 1·262 | 0·768 | 0·113 |

$CO_3^-$ was not found in any sample.

TABLE 6

DUSTFALL DURING STORM AND HIGH WIND

AT JODHPUR DURING 1964

(metric tons/sq km)

Type of collector—Aluminium Pan-dry

WI—Water insolubles : WS—Water solubles

| Month | Duration of storm and high wind | | WI | WS | Dustfall |
|---|---|---|---|---|---|
| | Date | No. of days | | | |
| May | 7–11 | 4 | — | — | 31·16 |
| | *11–13 | 2 | 24·63 | 2·26 | 26·89 |
| | *13–14 | 1 | 119·9 | 1·76 | 121·66 |
| | 19–21 | 2 | — | — | 24·52 |
| | 21–27 | 6 | — | — | 22·46 |
| | *27–29 | 2 | 82·6 | 1·29 | 83·89 |
| | 29–30 | 1 | — | — | 17·72 |
| | 30–1 $\frac{6}{64}$ (up to 11 A.M.) | 2 | 24·67 | 1·03 | 25·70 |
| June | *1– 2 | 1 | 36·36 | 0·49 | 36·85 |
| | 10–17 | 7 | — | — | 29·30 |
| July | *1– 3 | 2 | 22·95 | 0·44 | 23·39 |
| | *3–10 | 7 | 17·8 | 0·24 | 18·04 |
| | | 37 | | | 464·59 |

*Rain has sometimes fallen.

occurred which amounted to 74% of that collected by the dry pan during the whole year. (The dustfall during the storm/high wind period was collected in a separate dry aluminium pan of the same dia *viz.* 122 cm and the percentage fall was therefore calculated with reference to the dry aluminium pan used for this year.

A comparison of the monthly dustfall with that of the storm period occurring in the corresponding month was made. It was found that a large quantity of dustfall is deposited by the storm and high wind. In the month of May 57·7% of this month's total dustfall was deposited during 20 days of storm and high wind. In June, it was 45·6% and in July, it was 61% of the respective month's total dustfall. In June, there were 8 days on storm and high wind ; in July, there were 9 such days.

(*ii*) 1965 (*see Table* 7)

In 1965, there were 36 days of storm and high wind which were spread over 5 months from March to July. During these 36 days, 242·2 metric tons of dustfall occurred which amounted to 40% of that collected by the Dustfall Collector during the whole year.

On making comparison of the monthly dustfall with that of the storm period occurring in the corresponding month, it was found that in the month of March, 21·5% of its total dustfall fell during one day's storm. Similarly, for the months, April, May, June and July, the values were 58·9%, 94%, 7·3%, 45·9% respectively, the duration of storm/high wind being 7 days, 21 days, 3 days and 4 days for corresponding months.

TABLE 7

DUSTFALL DURING STORM AND HIGH WIND

JODHPUR, 1965

(metric tons/sq km)

WI—Water insolubles : WS—Water solubles.

| Month | Duration of storm and high wind | | WI | WS | Total dustfall |
|---|---|---|---|---|---|
| | Date | No. of days | | | |
| March | 30–31 | 1 | 11·44 | 1·21 | 12·65 |
| April | 10–14 | 4 | 8·64 | 0·87 | 9·51 |
| | 17–19 | 2 | 10·27 | 0·56 | 10·83 |
| | 23–24 | 1 | 4·34 | 0·22 | 5·56 |
| May | 1–3 | 2 | 4·49 | 0·79 | 5·28 |
| | 3–4 | 1 | 7·98 | 0·44 | 7·42 |
| | 4–7 | 3 | 5·23 | 0·64 | 5·87 |
| | 7–15 | 8 | 5·97 | 0·75 | 6·72 |
| | 17–18 | 1 | 7·55 | 0·28 | 7·83 |
| | 18–19 | 1 | 7·83 | 0·99 | 8·82 |
| | 21–24 | 3 | 34·42 | 0·93 | 35·35 |
| | 26–27 | 1 | 6·16 | 0·45 | 6·61 |
| | 27–28 | 1 | 13·98 | 0·91 | 14·89 |
| June | 26–29 | 3 | 8·43 | 0·16 | 8·59 |
| July | 7–10 | 3 | 87·92 | 0·48 | 88·40 |
| | 16–17 | 1 | 7·10 | 0·80 | 7·90 |
| | | | | | 242·2 |

TABLE 8

ANALYSIS OF WATER SOLUBLES OF THE DUSTFALL OCCURRING DURING STORM AND HIGH WIND AT JODHPUR IN 1965

(metric tons/sq km)

| Month | Duration of storm and high wind | | pH | Conductivity (micromhos/cm at 25°C) | $HCO_3^-$ | $Cl^-$ | $Ca^{++}$ | $Mg^{++}$ |
|---|---|---|---|---|---|---|---|---|
| | Date | No. of days | | | | | | |
| March | 30–31 | 1 | 7·98 | 189 | 0·255 | 0·008 | 0·209 | 0·01 |
| April | 10–14 | 4 | 5·4 | 90 | 0·117 | 0·016 | 0·099 | 0·008 |
| | 17–19 | 2 | 6·82 | 78 | 0·174 | Nil | 0·114 | 0·011 |
| | 23–24 | 1 | 8·04 | 74 | 0·175 | Nil | 0·031 | 0·004 |
| May | 1–3 | 2 | 6·58 | 96 | 0·20 | 0·009 | 0·095 | 0·009 |
| | 3–4 | 1 | 8·0 | 161 | 0·308 | 0·013 | 0·084 | 0·007 |
| | 4–7 | 3 | 8·1 | 118 | 0·331 | 0·014 | 0·010 | 0·007 |
| | 7–15 | 8 | 6·76 | 55 | 0·316 | 0·012 | 0·063 | 0·017 |
| | 17–18 | 1 | 6·82 | 46 | 0·175 | 0·009 | 0·043 | Nil |
| | 18–19 | 1 | 6·7 | 55 | 0·717 | 0·017 | 0·165 | Nil |
| | 21–24 | 3 | 6·82 | 128 | 0·862 | 0·042 | 0·025 | 0·015 |
| | 26–27 | 1 | 7·26 | 130 | 0·441 | 0·017 | 0·018 | 0·004 |
| | 27–28 | 1 | 6·72 | 61 | 0·538 | 0·014 | 0·014 | 0·010 |
| June | 26–29 | 3 | 7·8 | 172 | 0·241 | 0·019 | 0·069 | 0·007 |
| July | 7–10 | 3 | 7·9 | 152 | 0·483 | 0·007 | 0·291 | 0·011 |
| | 16–17 | 1 | 7·54 | 147 | 0·926 | 0·275 | 0·134 | 0·022 |
| Total falls : | | | | | 6·259 | 0·472 | 1·464 | 0·142 |

TABLE 9

MECHANICAL ANALYSIS

| BS Sieve | I* Percentage of dustfall retained by BS Sieve | II* Percentage of water insolubles retained by BS Sieve | III* Percentage of dustfall retained by BS Sieve |
|---|---|---|---|
| 52 | 1·48 | 4·75 | 3·60 |
| 72 | 1·19 | 3·10 | 2·0 |
| 100 | 4·40 | 5·83 | 4·72 |
| 150 | 6·54 | 4·54 | 3·96 |
| 200 | 43·67 | 27·52 | 20·71 |

*I. Refers to the Dustfall by Dry Pan. Feb–July 1964.

*II. Refers to the water insolubles by Al-Pan. Feb–July 1964.

*III. Refers to Dustfall during storm and high wind, 1965.

*Transport of ions during storm and high wind period*, 1965

The fall of $HCO_3^-$, $Cl^-$, $Ca^{++}$, $Mg^{++}$ ions during the period of storm and high wind in 1965 was found to be respectively, 6·26, 0·47, 1·46 and 0·11 metric ton per sq km (see Table 8). These ionic transports amounted to 40·4% ($HCO_3^-$), 17·6% ($Cl^-$), 26·2% ($Ca^{++}$) and 7·7% ($Mg^{++}$) of the total amount of annual transport of these ions, as recorded by the Dustfall Collector.

*pH*

In 1964 monthly samples, *pH* varied between 7·24 and 8·22 (Table 3). The average *pH* is 7·6. In 1965, the *pH* varied between 6·22 and 7·96 in wet Pan samples (Table 4) and between 6·60 and 8·0 in Dustfall Collector monthly samples (Table 5), the average *pH* being 7·3 in both cases.

In 1965, the storm and high wind samples gave *pH* between 5·4 and 8·1 (Table 8) the average value being 7·2.

*Particle size*

(*a*) *Monthly samples*, 1964

The monthly samples (February–July), obtained by the dry as well as wet aluminium pan in 1964 was subjected to mechanical analysis by B.S. Sieve. The average value of the percentage of dustfall retained by the sieves is given in Table 9. It may be seen that 43·67% of the dustfall have particle size between 104 $\mu$ and 76 $\mu$ (*i.e.* between B.S. 150 and 200) and it can be easily calculated that 42·72% of the dustfall has particle size less than 76 $\mu$ Table 9 (I).

In a similar way, it can be seen that 27·52% of the water insolubles of the dustfall occurring in 1964 between February and July, had particle size between 104 $\mu$ and 76 $\mu$ and 54·26% 76 $\mu$ Table 9 (II).

(*b*) *Storm and high winds*

The dustfall occurring during any storm and high wind period of 1965 was subjected to mechanical analysis. The percentage of dustfall in specific size range is given in Table 9 (III). It may be seen that 20·71% of the dustfall had particle size between 104 $\mu$ and 76 $\mu$ and 65·01" below 76 $\mu$.

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