that the ITCZ extended up to 300 mb. In this connection it may be mentioned that even in July, when active monsoon conditions prevail, the depth of the westerly current over the east Arabian Sea does not extend beyond 40 mb level. The depth being still lower over the west Arabian Sea. Easterlies are normally found at 500 and 300 mb level even at the equator. During 1973, the monsoon had established over the Kerala coast only after 3rd June, the extension during the last week of May was purely temporary and had receded immediately after the system moved westwards. Thus the extension of the ITCZ up to 300 mb in the last week of May, even to a higher level than in July, when the monsoon is fully established, was only due to the presence of the disturbance.

4. They have also found that the equatorial westerlies are drier than the westerlies to their north and to the south of the ITCZ or the easterlies to the south of the southern hemisphere equatorial trough and on this basis they have concluded that the moisture to the north of the equatorial westerlies does not come from the southern hemisphere, at least not directly across the southern hemisphere trough and its source lies in the equatorial westerlies in the northern hemisphere being due to either evaporation from the ocean or advection from west of longitude 55°E or both. The ships observations during MONEX 1973 period near 45°E just to the south of the equator, showed very high humidity (more than 80 percent) in the middle and upper troposphere (Desai et al. 1976). As such the westerlies to the north of about 5°N, which are in continuation of the southerlies crossing equator would also have high humidity, although the air which crosses the equator will pick up some moisture from the sea surface while moving northeastwards over warmer latitudes in the Arabian Sea. ITCZ by definition is the convergence zone between the airmasses from the southern and northern hemispheres and if one is to accept Godbole and Ghosh's argument that the moist westerlies have their origin in the northern hemisphere itself one cannot describe the boundary between such westerlies and the easterlies as ITCZ. Thus the conclusions of Godbole and Ghosh on the structure of the ITCZ during the last week of May are only with reference to the westward moving disturbance and as such cannot be generalised. Their conclusions on the origin of equatorial westerlies and its role in monsoon activity are also not acceptable.

5. I wish to express my sincere gratitude to Dr. B. N. Desai for his valuable suggestions.

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24 January 1977

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621.43: 551.586

MOISTURE CONSERVATION IN SOIL UNDER A VEGETAL COVER

The dry-weight percentage of soil-moisture under a 15 cm thick grass cover was found to be constantly in excess over that under bare soil. In a uniform soil plot of 50 m x 50 m area, one half is left barren and in another half grass was grown. The soil belongs to red loamy type formed due to weathering of local Khondalitic rocks of Eastern Ghats. The barren half is maintained by weekly mowing the grass without disturbing the surface soil.

A simultaneous collection of soil samples at 15 cm depth in both halves was made repeatedly during the rainy season of 1976. Samples were collected after a six hour lapse if and when there was a rainfall to ensure completion of ‘infiltration’.

2. The variation of soil moisture in the two conditions during the observation period is shown in Fig. 1 along with the rainfall. The moisture percentage under vegetal cover is regularly in excess over that in the bare soil. The ‘excess’ amount, however, varied during the period. The amount
TABLE 1

<table>
<thead>
<tr>
<th>Date</th>
<th>Soil moisture dry weight percentage</th>
<th>Sample No.</th>
<th>Vegetal cover</th>
<th>Bare soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 Jul</td>
<td></td>
<td>1</td>
<td>6.58</td>
<td>4.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>5.56</td>
<td>4.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>5.72</td>
<td>4.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>6.07</td>
<td>4.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>4.80</td>
<td>4.92</td>
</tr>
<tr>
<td>Mean Standard deviation</td>
<td>5.74</td>
<td>4.65</td>
<td>0.346</td>
<td>0.066</td>
</tr>
<tr>
<td>17 Aug</td>
<td></td>
<td>1</td>
<td>7.44</td>
<td>8.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>6.61</td>
<td>5.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>6.47</td>
<td>5.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>6.49</td>
<td>4.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>8.50</td>
<td>5.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>6.04</td>
<td>4.64</td>
</tr>
<tr>
<td>Mean Standard deviation</td>
<td>6.93</td>
<td>5.57</td>
<td>0.671</td>
<td>1.868</td>
</tr>
</tbody>
</table>

Fig. 1. Variation of moisture content under vegetal cover and bare soil conditions

has a maximum value of 3.08 per cent on 2 Sep 1976 (V.C.-12.13 per cent and B.S.-9.05 per cent) and a minimum value of 0.2 per cent on 21 Sep 1976 (V.C.-6.04 per cent and B.S.-5.84 per cent). The 'excess' character is present not only after rainy days, when the moisture content is high but during dry spells also, though there is a relative fall in both the moisture contents.

3. To confirm, whether the character is laterally also true, few samples were taken at random twice during the period from both the sites of the plot. The observations are shown in Table 1. While the standard deviation among the bare soil samples was large, consistency exists for samples under grass cover. The 'mean excess value' comes around 1 per cent.

4. The common concept that any vegetated surface is liable to extract more moisture due to evapotranspiration (Penman 1948, Vethmeyer and Brooks 1954) needs consideration of type of vegetation also. Monteith (1965) mentioned the possibility of a 'low evapotranspiration rate due to the negligible extraction of moisture from soil by non vascular vegetation like grass'. He further mentioned the role of 'albedo' in determining evaporation from soil. A bare wet soil which has an 'albedo' of 9-15 percent receives higher radiant energy than grass with an 'albedo' of 15-30 percent. Herbert et al, (1964) referred to the 'shelter effect' provided by the vegetal cover.
wherein the kinetic energy needed for the water molecules to escape is impeded by installing a ‘blanket’ over soil for wind movement. The effect is similar to soil and paper mulches reported by Smith (1931) in conserving moisture.

5. As such, the bare soil undergoing active evaporation is depleting the moisture rapidly at 15 cm depth. A limited areal divergence also is possible due to inherent inhomogenities in bare soil exposition (Reynolds 1974). Further, the interception of rain water by grass, which leads to effective percolation later, will also be an additional factor to determine the higher moisture content. However, as the results are for a brief period and preliminary in nature, further study is necessary for detailed understanding of the phenomenon.

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