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5. LABORATORY TEST

5.1 The hardness of blades was determined at edge and shank portion. The results of hardness test are tabulated in Table-I.

<table>
<thead>
<tr>
<th>Description</th>
<th>As per IS:6690:1981 (HRC)</th>
<th>Hardness as observed (HRC)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge portion</td>
<td>53 to 59</td>
<td>42.5 to 45.4</td>
<td>Does not conform</td>
</tr>
<tr>
<td>On shank portion</td>
<td>37 to 45</td>
<td>42.5 to 45.4</td>
<td>Conforms</td>
</tr>
</tbody>
</table>

5.2 Chemical composition

The chemical composition of blades is tabulated in Table-2.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Material</th>
<th>Requirement as per IS:6690:1981 (% by weight)</th>
<th>As observed (% by weight)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Carbon (C)</td>
<td>0.50 to 0.60</td>
<td>0.2119</td>
<td>Does not conform</td>
</tr>
<tr>
<td>2.</td>
<td>Silicon (Si)</td>
<td>1.50 to 2.00</td>
<td>0.7220</td>
<td>Does not conform</td>
</tr>
<tr>
<td>3.</td>
<td>Manganese (Mn)</td>
<td>0.50 to 1.00</td>
<td>0.8145</td>
<td>Conforms</td>
</tr>
<tr>
<td>4.</td>
<td>Sulphur (S)</td>
<td>0.05 (max)</td>
<td>Nil</td>
<td>Conforms</td>
</tr>
<tr>
<td>5.</td>
<td>Phosphorous (P)</td>
<td>0.05 (max)</td>
<td>0.0094</td>
<td>Conforms</td>
</tr>
</tbody>
</table>

6. FIELD TEST

The field tests of the implement comprising of dry and wet land operations were conducted for 21.28 & 15.14 hours respectively to assess the performance of the implement. The details of tractor used for field operations are given in Annexure-I.

The tractor pto speed was maintained at 540 rpm. The performance of implement is reported in Annexure-II and summarized in Table-3.
TABLE-3

Summary of field performance

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameters</th>
<th>Dry land operation</th>
<th>Wet land operation (puddling)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Tractor used</td>
<td>Mahindra Arjun-555 DI (Ultra-I)</td>
<td>Mahindra Arjun-555 DI (Ultra-I)</td>
</tr>
<tr>
<td>ii)</td>
<td>Type of soil</td>
<td>Sandy Loam</td>
<td>Sandy Loam</td>
</tr>
<tr>
<td>iii)</td>
<td>Av. Soil moisture, %</td>
<td>11.0 to 20.0</td>
<td>--</td>
</tr>
<tr>
<td>iv)</td>
<td>Depth of standing water, cm</td>
<td>--</td>
<td>5 to 7</td>
</tr>
<tr>
<td>v)</td>
<td>Field efficiency, %</td>
<td>77.09 to 83.78</td>
<td>--</td>
</tr>
<tr>
<td>vi)</td>
<td>Puddling Index, %</td>
<td>--</td>
<td>67 to 70</td>
</tr>
<tr>
<td>vii)</td>
<td>Av. Speed of operation, kmph</td>
<td>2.71 to 3.03</td>
<td>2.50 to 2.51</td>
</tr>
<tr>
<td>viii)</td>
<td>Av. Depth of cut, cm</td>
<td>7 to 8</td>
<td>--</td>
</tr>
<tr>
<td>ix)</td>
<td>Av. depth of puddle, cm</td>
<td>--</td>
<td>11.03 to 12.43</td>
</tr>
<tr>
<td>x)</td>
<td>Av. Working width, m</td>
<td>1.756 to 1.822</td>
<td>--</td>
</tr>
<tr>
<td>xi)</td>
<td>Area covered, ha/h</td>
<td>0.403 to 0.418</td>
<td>--</td>
</tr>
<tr>
<td>xii)</td>
<td>Time required for one hectare, h</td>
<td>2.39 to 2.48</td>
<td>--</td>
</tr>
<tr>
<td>xiii)</td>
<td>Fuel consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- l/h</td>
<td>5.576 to 6.366</td>
<td>3.86 to 4.25</td>
</tr>
<tr>
<td></td>
<td>- l/ha</td>
<td>13.768 to 15.243</td>
<td>--</td>
</tr>
</tbody>
</table>

6.1 Rate of work
6.1.1 Dry land operation
The rate of work in sandy loam soil was recorded as 0.403 to 0.418 ha/h and the forward speed as 2.71 to 3.03 kmph. The time required to cover one hectare area was recorded as 2.39 to 2.48 h.

6.1.2 Wet land operation
Speed of operation varied from 2.50 to 2.51 kmph.

6.2 Quality of work
6.2.1 Dry land operation
The depth of operation was recorded as 7 to 8 cm. The field efficiency was recorded as 77.09 to 83.78 %.

6.2.2 Wet land operation
Depth of puddle was recorded as 11.03 to 12.43 cm. Puddling index was recorded as 67 to 70 %.

6.3 Wear of blades
6.3.1 On mass basis
Wear of hatchet blades (mass basis) after 36.42 hrs. of field operation is tabulated in Table-4.
9. **SOUNDNESS OF CONSTRUCTION**
   No breakdown occurred during 36.42 hrs. of operation in the field.

10. **COMMENTS & RECOMMENDATIONS**

10.1 The dimensions of three point linkage of the implement does not conform to IS: 4468-March 2007(Part-I). Standard three point linkage system should be used at regular production level.

10.2 It is recommended to have provision for change in rotor speed to suit wider range of soil and soil moisture conditions.

10.3 Maneuverability of tractor with rotavator and quality of work were observed to be satisfactory.

10.4 Dimensions of power input shaft of rotavator does not conform to IS: 4931:1995. The shaft with specification comply with BIS standard under reference should be used at regular production level.

10.5 The hardness of hatchet blades in the edge portion and in the shank portion was 42.5 to 45.4 HRC against the requirement of 53 to 59 HRC (edge portion) and 37 to 45 HRC (on shank portion) as per IS:6690-Jan. 2007. This calls for improvement at production level.

10.6 The percentage wear of hatchet blades on mass basis during field operation 36.42 hrs., ranged from 0.960 to 1.880 % which is normal.

10.7 The percentage wear of hatchet blades on dimensional basis after field operation 36.37 hrs., ranged from 3.814 to 9.783 % and 1.029 to 3.746 % respectively at edge and at 65 mm from edge.

10.8 The PTO power requirement of rotavator during field test was observed from 13.20 to 23.21 kW in dry land operation. Which is 43.13 to 75.84 percent of maximum PTO power at standard PTO speed (30.6 kW @ 540 rpm) of tractor used.

10.9 Propeller shaft is provided with safety bolt

10.10 An identification plate is provided on trailing board of rotavator. The weight of the implement and power requirement may also be provided on it.

10.11 Carbon, Silicon & Manganese content of rotar blade are lower than the limit as specified in IS:6690-2007, therefore these should be looked into in future at regular production level.

10.12 The safety warnings and hazard decals are not provided on the machine. It should be provided. The labels of maintenance instructions and oil/lubricants grade, capacity, level etc. may also be provided on machine.