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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>49.2 to 51.7</td>
<td>Does not conform</td>
</tr>
<tr>
<td>On shank portion</td>
<td>37 to 45</td>
<td>49.2 to 51.7</td>
<td>Does not conform</td>
</tr>
</tbody>
</table>

TABLE-2

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>0.2791</td>
<td>Does not conform</td>
</tr>
<tr>
<td>2.</td>
<td>Silicon(Si)</td>
<td>1.50 to 2.00</td>
<td>0.3121</td>
<td>Does not conform</td>
</tr>
<tr>
<td>3.</td>
<td>Manganese (Mn)</td>
<td>0.50 to 1.00</td>
<td>0.7439</td>
<td>Conforms</td>
</tr>
<tr>
<td>4.</td>
<td>Sulphur (S)</td>
<td>0.05 (max)</td>
<td>0.0069</td>
<td>Conforms</td>
</tr>
<tr>
<td>5.</td>
<td>Phosphorous (P)</td>
<td>0.05 (max)</td>
<td>0.0158</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 20.35 & 15.40 hours respectively in different soil moisture conditions 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. Parameters</th>
<th>Dry land operation</th>
<th>Wet land operation (puddling)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Tractor used</td>
<td>Mahindra-555 DI, Arjun</td>
<td>Mahindra-605 DI, Arjun</td>
</tr>
<tr>
<td>ii) Type of soil</td>
<td>Sandy loam</td>
<td>Sandy loam</td>
</tr>
<tr>
<td>iii) Av. Soil moisture, %</td>
<td>11.0 to 20.0</td>
<td>--</td>
</tr>
<tr>
<td>iv) Depth of standing water, cm</td>
<td>--</td>
<td>4.7 to 5.5</td>
</tr>
<tr>
<td>v) Field efficiency, %</td>
<td>81.21 to 89.21</td>
<td>--</td>
</tr>
<tr>
<td>vi) Puddling Index, %</td>
<td>--</td>
<td>71.74 to 74.8</td>
</tr>
<tr>
<td>vii) Av. Speed of operation, kmph</td>
<td>2.79 to 2.96</td>
<td>2.36 to 2.38</td>
</tr>
<tr>
<td>viii) Av. Depth of cut, cm</td>
<td>7.20 to 8.60</td>
<td>--</td>
</tr>
<tr>
<td>ix) Av. depth of puddle, cm</td>
<td>--</td>
<td>11.23 to 11.50</td>
</tr>
<tr>
<td>x) Av. Working width, m</td>
<td>2.006 to 2.129</td>
<td>--</td>
</tr>
<tr>
<td>xi) Area covered, ha/h</td>
<td>0.493 to 0.522</td>
<td>--</td>
</tr>
<tr>
<td>xii) Time required for one hectare, h</td>
<td>1.91 to 2.03</td>
<td>--</td>
</tr>
<tr>
<td>xiii) Fuel consumption</td>
<td>- l/h</td>
<td>6.096 to 6.800</td>
</tr>
<tr>
<td></td>
<td>- l/ha</td>
<td>4.17 to 4.27</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 0.493 to 0.522 ha/h and the forward speed as 2.79 to 2.96 kmph.
The time required to cover one hectare area was recorded as 1.91 to 2.03 h.

6.1.2 Wet land operation
Speed of operation varied from 2.36 to 2.38 kmph.

6.2 Quality of work

6.2.1 Dry land operation
The depth of operation was recorded as 7.20 to 8.60 cm.
The field efficiency was recorded as 81.21 to 89.21 %.

6.2.2 Wet land operation
Depth of puddle was recorded as 11.23 to 11.50 cm.
Puddling index was recorded as 71.74 to 74.8 %.

6.3 Wear of blades

6.3.1 On mass basis
Wear of hatchet blades (mass basis) after 35.75 hrs. of field operation is tabulated in Table-4.
8. EASE OF OPERATION, ADJUSTMENTS & SAFETY

8.1 Propeller shaft is provided with safety bolt as its safety device.

8.2 The propeller shaft has telescopic sections with universal joints, to adjust the length of drive shaft, which is adequate.

8.3 Depth adjustment can be made by raising or lowering the skids.

8.4 Implement does not have provision to vary rotor shaft speed to cater to different soil and moisture conditions.

8.5 Operator has to get down from tractor to make adjustments in rotavator.

9. SOUNDNESS OF CONSTRUCTION

No breakdown occurred during 35.75 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 (Part-I):1997. 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 49.2 to 51.7 HRC against the requirement of 53 to 59 HRC (edge portion) and 37 to 45 HRC (on shank portion) as per IS:6690:1981. This calls for improvement at production level for hardness of rotor blade at its shank portion.

10.6 The percentage wear of hatchet blades on mass basis during field operation 35.75 hrs, ranged from 1.06 to 2.17 % which is normal.

10.7 The percentage wear of hatchet blades on dimensional basis after field operation 35.75 hrs, ranged from 2.14 to 8.00 % and 0.78 to 2.63 % respectively at edge and at 65 mm from edge.
10.8 The PTO power requirement of rotavator during field test was observed from 13.73 to 26.60 kW in dry land operation. Which is 44.86 to 86.92 percent of maximum PTO power at standard PTO speed (30.6 kW) of the tractor used.

10.9 An identification plate is provided on trailing board of rotavator. Mass of the implement and approx power requirement may also be added.

10.10 The safety bolt is provided in propeller shaft to protect from overloading.

10.11 Carbon & silicon content of rotar blade are lower that the limit as specified in IS:6690:1981 and therefore this should be taken care 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 instruction and oil/lubricant grade, capacity, level etc. may also be provided.

11. LITERATURE :-
Manufacturer has provided a booklet containing operator manual, part catalogue and service manual for reference during test in English. However, it should be updated as per IS:8132:1983 in Hindi & other regional languages and provides with machine for guidance of users & technical personnel.

TESTING AUTHORITY

<table>
<thead>
<tr>
<th>G.R. AMBALKAR</th>
<th>R.K. NEMA</th>
<th>HIMAT SINGH</th>
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<tbody>
<tr>
<td>Agricultural Engineer</td>
<td>Senior Agricultural Engineer</td>
<td>Director</td>
</tr>
</tbody>
</table>

Test report compiled by: Sh. Maan Singh, Sr. Tech. Assistant

12. APPLICANT’S COMMENTS

<table>
<thead>
<tr>
<th>Para No.</th>
<th>Our Reference</th>
<th>Applicant’s Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.1</td>
<td>--</td>
<td>We will make improvements in the components which does not conform to Indian Standard.</td>
</tr>
</tbody>
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