



FARM MACHINERY TESTING CENTRE
DEPARTMENT OF FARM MACHINERY AND POWER ENGINEERING
COLLEGE OF TECHNOLOGY & ENGINEERING
Maharana Pratap University of Agriculture and Technology
Udaipur (Raj.)-313001

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Dr. Y.C. Bhatt
PI (FMTC)

No. CTAE/FMP/FMTC/2016/ 297

Date: 29.09.2016

To,
M/s Shreeji Agro Industries,
Panchar Road, Near Shreeji PVC Pipe,
Wankaner (Gujarat)
Pin: 363621

Subject: Test Report of Two Bottom Hydraulically Reversible M. B. Plough (2FH45011)

Sir,

This is in reference to your application dated 21.07.2016 and testing fees deposited vide Challan number 119 dated 21.07.2016 for testing of **Two Bottom Hydraulically Reversible M. B. Plough (2FH45011)**. The test of the machine has been conducted. The test report (No.: CTAE/FMP/FMTC/2016/63) of the machine is enclosed with this letter.

Thanking you

Dr. Y. C. Bhatt

Principle Investigator,
Farm Machinery Testing Centre

Encl:

1. One copy of test report (No.: CTAE/FMP/FMTC/2016/63)

Test Report No.	Name of the Machine/Implement	Month	Year
CTAE/FMP/FMTC/2016/63	TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH	September	2016



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(The Institute is approved Testing Centre by Department of Agriculture & Cooperation, Ministry of Agriculture, GOI vide letter no. 8-1/2004-My (I&P) dated September 14, 2010 and subsequent letters)

Test Report No.	Name of the Machine/Implement, Model No.	Month	Year
CTAE/FMP/FMTC/2016/63	TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH	September	2016



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Type of test	:	Commercial
Name of machine	:	Two Bottom Hydraulically Reversible M.B. Plough
Test code referred	:	IS: 6288 -1971(Reaffirmed in 2004) (Test Code for Mould board Ploughs) IS: 10691-1983 (Reaffirmed in 2006) (Specification for Share for Tractor Operated Mould board Ploughs) IS: 4468 (Pt-I)-1997 (Reaffirmed in 2001) (Agricultural Wheeled Tractors-Rear Mounted Three-point Linkage)
Test requested by	:	M/s Shreeji Agro Industries, Panchar Road, Near Shreeji PVC Pipe, Wankaner 363 621, Gujarat
Testing authority	:	Farm Machinery Testing Centre, Deptt. of Farm Machinery and Power Engineering, CTAE, MPUAT, Udaipur-313001
Period of test	:	June 2016 – August 2016

1. This Test Report should not be reproduced in part or full without prior permission of the Incharge Testing Centre.
2. The data given in the Test Report pertain to the particular machine submitted for test by the Applicant.
3. The data collected during the test do not in any way attribute to the durability of the machine.
4. The results reported in this report are observed values and no corrections have been applied for atmospheric and site conditions.

Selected Conversions

S. No.	Units	Conversion Factor
1	Force	
	1 kgf	9.80665 N 2.20462 lbf
2	Power	
	1 hp	1.01387 metric hp (Ps) 745.7 W
	1 Ps	735W
	1 kW	1.35962 Ps
3	Pressure	
	1 psi	6.895 kPa
	1 kgf/cm ²	98.067 kPa = 735.56 mm of Hg
	1 bar	100 kPa = 10 N/cm ²
	1 mm of Hg	1.3332 m-bar

CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	3
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CONTENTS

S. No.	Contents	Page No.
1	Scope of test	4
2	Method of selection	4
3	Specifications	4
4	Conformity to Indian Standards	10
5	Laboratory test	11
6	Field performance test	12
7	Defects breakdowns and repairs	15
	Annexure I, II & III	16-19

CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	4
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1. SCOPE OF TEST

1.1 LABOTATORY TEST

- Checking of specifications
- Hardness of soil engaging components of plough

1.2 FIELD TEST

- Quality of work
- Rate of work
- Labour requirement
- Power requirement
- Ease of operation and adjustment
- Defects, breakdowns and repairs



2. METHOD OF SELECTION

The test sample was directly submitted by the applicant for test at this Institute.

3. SPECIFICATIONS

- 3.1 General** :
- Name of implement : Two bottom hydraulic reversible mould board plough
- Name and Address of Manufacturer : M/s Shreeji Agro Industries, Panchar Road, Near Shreeji PVC Pipe, Wankaner 363 621
- Type of implement : Tractor mounted (Two way)
- Make : Shreeji
- Model : 2FH 450 11
- Serial number : 33
- Number of plough bottoms : Two
- Year of manufacture : 2016
- Recommended power : 45-55 hp tractor
- Tractor used : John Deere 5053S (45 hp)
- 3.2 Constructional details**
- 3.2.1 Frame** : Frame is made by welding one straight flat of size 944×100.69×25.06 mm and another bend MS flat of size 986×100.56×25.10 on MS flat of size 330×98.95×24.82 mm at

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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	5
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front and both flats are bolted together at rear end with rear standard in between them. Both flats are bolted between two MS flats of size 225×100.40×10.09 mm with three nut and bolts which are firmly welded at front end. A slender member made of MS flat of size 225×98.80×24.5 mm is provided at middle of the frame.

Size of bolt, mm : 99.54×18.63 φ
Dimensions (mm) :
 Length, mm : 944
 Width, mm : 329
 Number, diameter & spacing of holes on mainframe for fixing each standard, mm : 03, 19.16 φ & 30

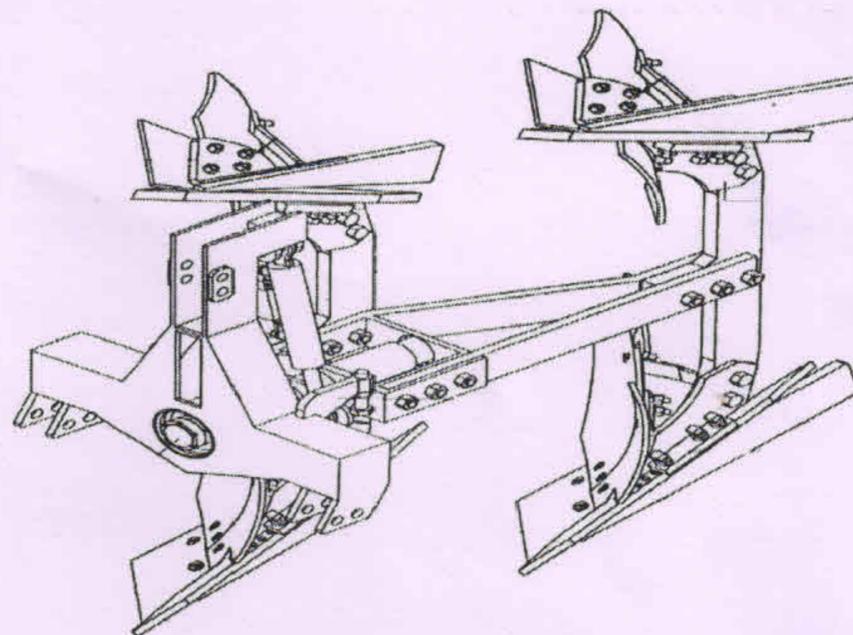


Fig. 1. Schematic view of 2-bottom hydraulic reversible mould board plough

3.2.2 Standard :
 Number : Two
 Material : Mild Steel
 Projected length, mm : 1115
 Curved length, mm : 1326
 width, mm : 373 at middle & 69.89 at end
 Thickness, mm : 27.07
 Method of fixing : Each standard is bolted to the main frame at the center with three nut and bolts, whereas outer ends are bolted to the frog to which plough bottom is fixed.
 Size of bolt, mm : 99.54×18.63φ

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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	6
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3.2.3	Plough Bottom	:	
	Constructional details	:	Plough bottom consisted of mould board, share, share-bar and landside bolted and welded to the frog.
	Number	:	Four (Two on each side)
	Size of plough, mm	:	2×320
	Vertical suction, mm	:	20.04-23.38
	Horizontal suction, mm	:	6.51-7.72
3.2.3.1	Mould board	:	
	Type	:	General purpose
	Material	:	M.S. Plate
	Length, mm	:	713 (Projected), 720 (Curved)
	Width, mm	:	360 (Projected), 389 (Curved)
	Thickness, mm	:	8.24
	No& size of hole on mould board, mm	:	7, 13.64φ
	Method of fixing mould board	:	Mould board is bolted to frog with the help of four nut and bolts.
	Type and size of bolts, mm	:	Countersunk bolts, 31.18×12.25φ
	Support for mould board	:	
	Constructional details	:	MS flat of size 290×40.43×9.76 mm bolted at one end on standard and on mould board at another end for stability of the mould board.
	Number	:	One for each mould board
	Material	:	Mild steel
3.2.3.2	Share	:	
	Type	:	Type-6 as per IS-10691-1983, reaffirmed in 2001
	Size, mm	:	490×157
	Thickness, mm	:	
	At middle	:	11.75
	At cutting edge	:	1.80-2.10
	Number & size of holes on share, mm	:	2, 13.97φ
	Method of fixing share	:	Share is bolted to the frog with two countersunk bolts each of size 38.30×12.46φ.



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3.2.3.2.1	Share bar	:	
	Material	:	Mild steel
	Size, mm	:	924×31.04×25.74
	Length of tapered section, mm	:	115.78
	Size of cutting edge, mm	:	
	Width	:	24.12
	Thickness	:	1.81-2.63
	No. & size of grooves on bar point, mm	:	13, 17.61φ
	Method of fixing	:	Share bar is inserted into bracket and locked in the groove provided on the share bar by lock bolt of size 64.74×15.63φ
3.2.3.3	Land Side	:	
	Number	:	Four (One for each plough bottom)
	Material	:	Mild steel
	Dimensions, mm	:	
	Projected Length	:	
	Front	:	537
	Rear	:	670
	Width	:	
	Front	:	63.47 (at middle), 130 (at end)
	Rear	:	79.15 (at middle), 135.52 (at end)
	Thickness	:	
	Front	:	25.06
	Rear	:	24.43
	Method of fixing of landside to frog	:	It is firmly welded to frog
3.2.3.4	Shin of share	:	
	Numbers	:	Four (One for each plough bottom)
	Material	:	Mild steel
	Length, mm	:	
	Projected	:	315
	Curved	:	335
	Width, mm	:	335
	Thickness, mm	:	11.04
	Method of fixing	:	It is bolted to frog with the help of two nut and bolts.
	Size of bolt, mm	:	30.70×12.24φ



CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	8
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- 3.2.3.5 Frog** :
- Number : Four (One for each plough bottom)
 - Material : Mild Steel
 - Method of fixing : It is fixed on the standard with the help of three nut and bolts of size 99.55×18.24φ.
 - No. and size of holes on frog, mm :
 - for standard : 3, 18.95φ
 - for mould-board : 5, 13.40φ
 - for share : 2, 13.92φ
- 3.2.4 Reverse mechanism** :
- Type : Hydraulic operated
 - Construction details : The reverse mechanism is operated through double acting hydraulic cylinder by hydraulic system of the tractor. The hydraulic cylinder is connected between upper and lower hitches, can enable the hitch pyramid to rotate through 180 degree around the main shaft. When the implement is hitched to the three-point linkage of tractor, hitch pyramid becomes fixed and the complete frame along with plough bottoms is free to rotate 180 degree along the axis of hollow shaft.
- 3.2.4.1 Hydraulic Cylinder** :
- Type : Double acting
 - Size of Cylinder, mm : 277×62.52φ (OD)
 - Stroke length, mm : 158.81
 - Diameter of the connecting rod, mm : 27.88φ
 - Size of high pressure pipeline : 1215×18.86 φ (OD)
 - Pressure rating of high pressure line : 330 bar
- 3.2.4.2 Center of pull adjustment** : Not Provided
- 3.2.4.3 Main Shaft** :
- The main shaft is fitted inside hollow pipe which is firmly welded to main frame.
 - Size, mm :
 - Length : 598
 - Diameter : 89.10
- 3.2.5 Hitch Pyramid** :
- Constructional details : The upper hitching system is made by welding two MS flats of size 126×12.43 mm. Lower hitching system is made up of hollow rectangular MS pipe of size 128×142 mm. Both upper and lower hitching systems are welded on hollow pipe of size 168.47φ (OD) which is fitted on main shaft with the help of two taper roller bearings (No. 3301C1) mounted on main frame.



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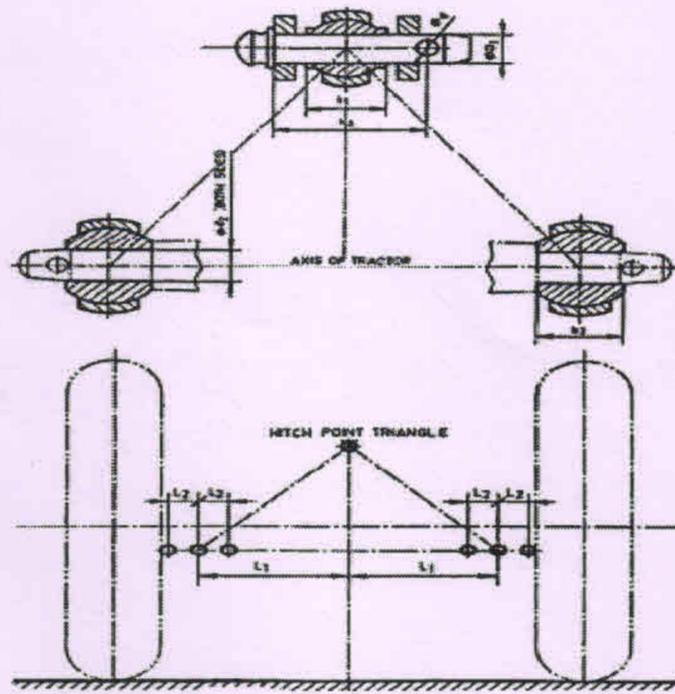


Fig. 2. Different dimensions of hitch pyramid

Specification of Hitch pyramid as per IS: 4468-1977

S. No.	Specifications	Dimensions (mm)		Remarks
		As per IS	As measured	
1.	Upper hitch points, mm			
	Diameter of hitch pin	25.27-25.40	25.38	Conforms
	Diameter of hitch pin hole	25.70-25.91	25.79	Conforms
	Linch pin hole distance	93 (Min.)	138.23	Conforms
	Width between inner surface of yoke	52.0 (Min.)	66.26	Conforms
	Width between outer surface of yoke	86 (Max.)	85.57	Conforms
2.	Lower hitch point, mm			
	Diameter of hitch pin	27.79-28.0	27.82	Conforms
	Diameter of hitch pin hole	28.70-29.03	29.00	Conforms
	Linch pin hole distance	49 (Min.)	123.65	Conforms
3.	Diameter of linch pin hole, mm			
	Upper hitch pin	12.0 (Min.)	12.32	Conforms
	Lower hitch pin	12.0 (Min.)	12.28	Conforms
4.	Mast height, mm	460 (Min.) 510 (Min.)	615	Conforms
5.	Lower hitch point span, mm	681.5-684.5 823.5-826.5	691	Conforms

3.3 Overall dimensions, mm

Length : 1685
Width : 1080
Height : 1305

3.4 Mass, kg : 435

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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	10
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4. CONFORMITY TO INDIAN STANDARDS

**Specifications of Share for Tractor-Operated Mould Board Plough as per IS:10691-1983
(Reaffirmed Feb 2006):**

Clause No.	Requirements as per IS	Observation	Conformity to IS
1	2	3	4
3	Types		
3.1	On the basis of the dimensions, the share shall be of following 7 types: a) Type 1, b) Type 2, c) Type 3, d) Type 4, e) Type 5, f) Type 6 and g) Type 7	As per the dimensions measured the share falls in Type 6 category	Conforms
7	OTHER REQUIREMENTS		
7.1	The cutting edge of the share shall be beveled to a distance not more than 10 mm.	7.21 mm	Conforms
	The thickness of cutting edge shall be between 0.5 to 2 mm and should be uniform, as far as possible.	Thickness of cutting varied between 1.80 to 2.10 mm	Conforms
7.2	The counter sunk bolt of 10 mm size shall be used for fixing the share with frog. As far as possible, the bolt of M10 size should be used.	Counter sunk bolt of 12.46 mm is used for fixing share	Conforms
7.3	The shares shall be supplied with bolts in holes	Supplied	Conforms
8	WORKMANSHIP AND FINISH:		
8.1	The shares shall be free from flaws, scratches, cracks and other defects. All fins, burrs, flashes and sharp edges other than the cutting edge shall be removed.	No such defects were noticed	Conforms
8.2	In case of steel shares, the welding of gunnels shall be satisfactory in all respect. The welding shall not be porous.	No such defects were noticed	Conforms
8.3	A coating of protective paint or grease on soil-facing surface of the share shall be provided. The bottom surface not in direct contact with soil shall have an anti-rust paint coating	provided	Conforms
9	MARKING AND PACKING		
9.1	The share shall be with the following particulars:		
	a) Manufacturer's name and recognized trade-mark, if any;	Not provided	---
	b) Size ;	Not Provided	---
	c) Type; and	Not Provided	---
	d) Batch/ code number.	Not Provided	---



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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	11
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5. LABORATORY TEST

5.1 Hardness:

5.1.1 Hardness of share:

Hardness as observed (Avg.)	Hardness as per IS: 6459-1972	Conformity to IS
HB		
360-371	350 to 450	Conforms

Remark: - The average hardness of the share was recorded between 360-371 HB against the requirement of 350 to 450 HB.

5.1.2 Hardness of Bar-Point:

Hardness as observed (Avg.)	Hardness as per IS: 6459-1972	Conformity to IS
HB		
355-368	350 to 450	Conforms

Remark: - The average hardness of the share bar was recorded between 355-368 HB against the requirement of 350 to 450 HB.

5.2 Chemical Analysis:

5.2.1 Chemical Analysis of share*:

Constituents	Chemical composition (%) as per IS: 10691- 1983	Chemical composition as observed (%)	Conformity to IS
Carbon (C)	0.70-0.80	0.73	Conforms
Manganese (Mn)	0.50-0.80	0.76	Conforms
Phosphorous (P)	0.050 (max)	0.027	Conforms
Sulpher (S)	0.050 (max)	0.020	Conforms

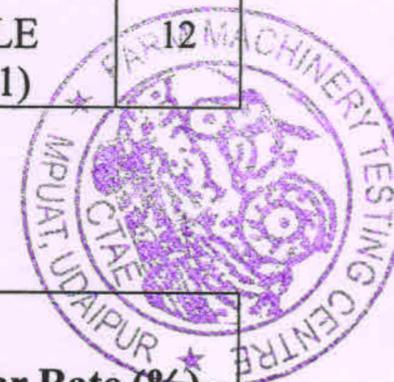
5.2.1 Chemical Analysis of share bar*:

Constituents	Chemical composition (%) as per IS: 10691 1983	Chemical composition as observed (%)	Conformity to IS
Carbon (C)	0.70-0.80	0.75	Conforms
Manganese (Mn)	0.50-0.80	0.77	Conforms
Phosphorous (P)	0.050 (max)	0.029	Conforms
Sulpher (S)	0.050 (max)	0.021	Conforms

*Supplied by the manufacture (Chemical Test certificate No. GN/16-17/05/587 dated 23/06/2016 issued by G.N. Altech, Samrat Industrial Area, Rajkot, Gujarat)

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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	12
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5.3 Wear of soil engaging critical components:

5.3.1 Share (Blade):

S. No.	Weight of share, kg		Per cent Wear	Wear Rate (%)
	Initial	After 40 hr		
1	4.492	3.737	16.80	0.42
2	4.639	3.692	20.40	0.51
3	4.411	3.564	19.20	0.48
4	4.828	3.958	18.00	0.45

5.3.2 Share (Bar):

S. No.	Weight of share bar, kg		Per cent Wear	Wear Rate (%)
	Initial	After 40 hr		
1	4.285	3.65	14.8	0.37
2	4.389	3.879	11.6	0.29
3	4.388	3.791	13.6	0.34
4	4.273	3.572	16.4	0.41

6. FIELD PERFORMANCE TEST

The field test of MB plough was conducted at CTAE farm, Udaipur with John Deere tractor as prime mover for operating the plough. The working of the Hydraulic reversible M.B. plough was observed satisfactory.

During the field test, data were collected and analyzed for quality of work, rate of work and draft of implement. The details of test result are given in following Table 1.

Table 1: SUMMARY OF FIELD PERFORMANCE TEST

S. No.	Parameter	Range
1	Type of soil	Sandy loam
2	Soil bulk density (g/cc)	1.55-1.62
3	Soil moisture (%)	12.8-15.75
4	Cone index of the soil(kPa)	
	Before ploughing operation	467-538
	After ploughing operation	105-122

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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	13
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5	Furrow length, m	175-176
6	Engine speed, rpm	
	No load	1500-1550
	On load	1335-1420
7	Speed of operation, km/h	3.92-4.10
8	Wheel slip, (%)	12.38-13.46
9	Depth of cut, cm	23-26
10	Width of cut, cm	62-64
11	Effective field capacity, ha/h	0.204-0.213
12	Field efficiency, %	83.54-84.15
13	Draft of implement, kgf	590-640
14	Time required to cover one hectare area, h	4.70-4.90
15	Fuel consumption, l/h	5.2-5.4

6.1.1 Rate of Work

- ❖ The rate of work was observed as 0.204-0.213 ha/h when speed of operation varied between 3.92-4.10 kmph.
- ❖ The time required for ploughing one hectare area was recorded as 4.70-4.90 h.
- ❖ The field efficiency of the implement was worked out as 83.54-84.15 %.

6.1.2 Quality of Work

- ❖ The depth of operation and working width of implement were measured as 23-26 cm and 62-64 cm respectively.

6.2 Labour requirement

- ❖ One skilled operator is needed to operate the tractor and the implement simultaneously.



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Fig. 3. Field testing of 2-bottom reversible mould board plough



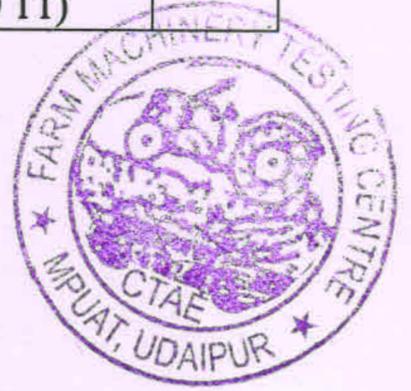
Fig. 4. Draft measurement of 2-bottom hydraulic reversible mould board plough

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6.3 Ease of operation and adjustments

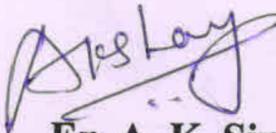
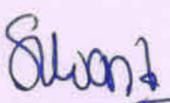
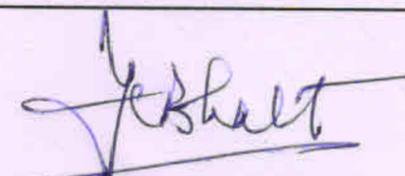
- ❖ The reversing of plough bottoms during field operation was satisfactory.
- ❖ The furrow opening by the plough was satisfactory.
- ❖ The primary tillage operation performed by plough was satisfactory.



7. DEFECTS BREAKDOWNS AND REPAIRS

No breakdown was occurred in the implement during the course of test.

TESTING AUTHORITY

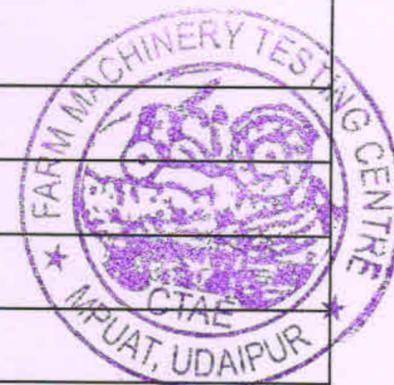
Field Test Conducted By:	 Er. A. K. Singh (SRF)
Test Report Prepared By:	 Er. S. V. Wandkar (SRF)
Test Report Checked By:	 Er. S. S. Vyas (Research Engineer)
Principle Investigator (FMTC)	 Dr. Y. C. Bhatt (Professor & PI)

CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	16
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ANNEXURE-I

BRIEF SPECIFICATION OF THE TRACTOR USED DURING FIELD OPERATION

1	Make, model and type	John Deere 5203 S, Four Wheel, general purpose Agriculture tractor
2	Number of cylinder	Three
3	Maximum PTO power, kW (Ps)	33.7(45.82) As per Test Report No. T-512/994 Dec. 2004
4	Rated engine speed, rpm	2400
5	No load engine speed during field test, rpm	----
6	Drawbar power, kW (Ps)	27.8(37.79)
7	Drawbar pull, kN:	
	- Without ballast	15.60
	- With ballast	20.05
8	Type of wheel equipment	Pneumatic
9	Number & size of tyre:	
	-Front	Two, 7.50-16, 6 PR
	-Rear	Two, 14.9-28, 12 PR
10	Standard track width, mm	
	-Front	1325
	-Rear	1410
11	Wheel base, mm	2050
12	Ballast condition	Used as ballasted
13	Total operational mass, kg:	
	-Front	980
	-Rear	1535
	- Total	2515



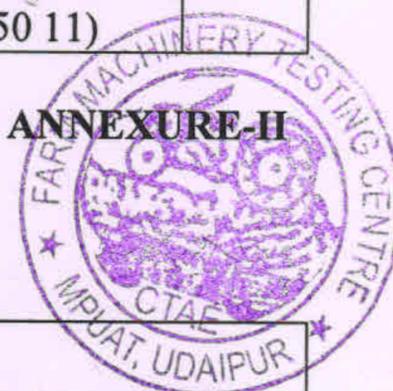
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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	17
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ANNEXURE-II

FIELD PERFORMANCE RESULTS

Place of test: CTAE farm, Udaipur



S. No.	Parameters	Test trials		
		I	II	III
1	Duration of test (h)	4.18	3.56	4.20
2	Furrow length	176	175	175
3	Type of soil	Sandy loam		
4	Bulk density (g/cc)	1.58	1.55	1.62
5	Soil moisture (%)	12.8	15.75	13.2
6	Previous treatment	Nil		
7	Engine speed (rpm)			
	-No load	1550	1535	1500
	-On load	1380	1420	1335
8	Cone index of the soil (kPa)			
	Before ploughing operation	471	467	538
	After ploughing operation	110	105	122
9	Forward speed (km/h)	3.96	4.10	3.92
10	Wheel slip (%)	12.38	12.64	13.46
11	Av. Depth of Cut (cm)	25	26	23
12	Av. Width of cut (cm)	64	62	62
13	Area covered (ha/h)	0.211	0.213	0.204
14	Time required for one ha (h)	4.74	4.70	4.90
15	Theoretical field capacity (ha/h)	0.253	0.254	0.243
16	Field efficiency (%)	83.54	84.15	83.96
17	Implement draft (kgf)	590	640	610
18	Fuel consumption (l/h)	5.3	5.2	5.4

Yashant

CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	18
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ANNEXURE: III

SYMBOLS AND ABBREVIATIONS

SYMBOLS

I. Symbols assigned to basic units

S.No.	Physical Quantity	Name of S.I. Unit	Symbol
1	Length	Meter	m
		Millimeter	mm
2	Mass	Kilogram	kg
3	Time	Second	S

II Symbols assigned to some derived units

S.No.	Physical Quantity	Name of S.I. Unit	Symbol
1	Area	Square centimeter	cm ²
		Square meter	m ²
		Hectare	ha
2	Mass	Gram	g
		Kilogram	kg
		Tonne	t
3	Speed/Velocity	Meter per second	m/s
		Kilometer/hour	km/h
4	pressure	Newton per square millimeter	N/mm ²
5	Time	Minute	min
		Hour	h
6	Volume	Cubic centimeter	cm ³
		Milliliter	ml
		Liter	l

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CTAE/FMP/FMTC/2016/63	TEST REPORT TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL: 2FH 450 11)	19
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ABBREVIATIONS

As per applicant	:	apa
Average	:	Av
Brinell hardness	:	HB
Clause	:	Cl
Degree	:	Degree
Diameter	:	Dia
Figure	:	Fig
Hour	:	h
Indian Standard	:	IS
Kilogram	:	kg
Maximum	:	Max.
Minimum	:	Min.
Millimeter	:	mm
Mild steel	:	MS
Number	:	No
Not available	:	NA
Not Recorded	:	NR
Percentage	:	%
Reference	:	Ref.



Yashant