



Research Article

COMPARISON OF DIMENSIONS OF COMMERCIALY AVAILABLE REVERSIBLE SHOVELS OF FIXED TYNE CULTIVATOR

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Abstract- Commercially available agricultural machines are not matching with standards which affect the performances. Many times, commercially available reversible shovels used in fixed tyne type tractor drawn cultivator do not match in dimensions as given in respective BIS code. A study conducted in Udaipur, Rajasthan revealed that out of four such shovels only one shovel T-2 fulfilled the requirement of BIS code 6023:1970 whereas maximum deviation was observed for shovel T-4.

Keywords- Length, Width, Concavity, Diameter of holes, Centre to centre distance of holes, Rake angle

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Introduction

Agriculture is one of the most important sectors of the Indian economy, accounting for 14% of the nation's GDP and about 11% of its export. It is currently growing at an average compound annual growth rate (CAGR) of 2.8% [1]. Agricultural engineering inputs have played an important role in increasing production through appropriate mechanization [2]. Cultivator is one of the most important tillage tools used by Indian farmer [3]. Reversible shovel, sweep, half sweeps, furrower etc. are the different types of tools that can be attached to a cultivator tyne for different applications. Reversible shovel and sweeps are primarily used for loosening and stirring the soil. The farmer uses reversible shovel in cultivator because of simplicity in attachment, cheaper cost and ease in repairs. Most of the farmers also use this shovel for primary cultivation. They do not usually have an inverting effect and penetrate more easily in hard grounds because of less upward soil reaction. Presently, many commercially available reversible shovels of various sizes are available in the market. Normally it has been observed that the dimensions of most of the commercially available cultivator shovels do not follow BIS standard in many aspects. They differ in geometry like length, width etc. The BIS code 6023-1970 for cultivator characterizes reversible shovel for cultivator for parameters like width and length. These parameters are given in a range so as to meet the requirements of various soil types and soil conditions. Mismatch with the standards in terms of geometry may affect the quality of work of cultivator and finally may affect the profitability in farming. Since, soil tool interaction is complex one; there is a need to study the performance of commercially available reversible shovels used in cultivator [4-6].

Materials and Methods

A survey was conducted to identify the commercially available reversible shovels used for tractor drawn fixed tyne cultivator in Udaipur region of Rajasthan. Out of various parameters given in BIS code 6023:1970, dimensions considered in the study are presented in [Fig-1] and their values as per BIS code 6023:1970 are given in [Table-1].

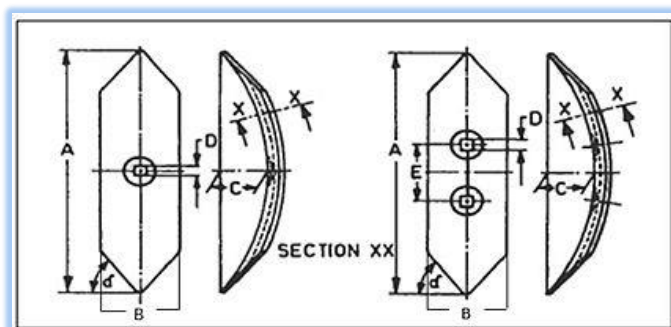


Fig-1 Reversible shovel as per BIS code 6023-1970

Table-1 Specification for Reversible Shovels BIS code 6023-1970

Particulars	Dimensions (mm)
Length (A)	270±2
Width (B)	75±2
Concavity (C)	35±1.6
Diameter of holes (D)	15±0.5
Centre to centre distance of holes (E)	45±0.25
Rake angle (α)	45±5 deg



Fig-2a Measuring Length with tape



2b Measuring width with Vernier calliper, 2c Measuring Rake angle with Angalometer



Fig-2d Measuring Concavity with Vernier calliper

Fig-2 Instruments used for measuring various dimensions of reversible shovels.

Results and Discussion

The various dimensions of the four shovels considered in the study which are in [Table-2]. The study showed that the dimensions of shovel 2 matched with BIS standard shovel.

Table-2 Dimensions of selected shovels

Tool	A ± 2 mm	B ± 2 mm	C ± 1	D ± 0.5	E ± 0.5	$\alpha \pm 5^\circ$
T-1	314	55.36	77.13	10.48	40.72	60°
T-2	270	75.20	35.00	15.10	45.25	45°
T-3	297	74.20	78.22	10.79	43.28	47°
T-4	340	116.2	58.34	12.64	44.19	55°

Comparison of dimensions of commercially available reversible shovels as per BIS standard

Length: Shovel T-4 measured highest length (25.92 percent higher) followed by T-1 (16.29 percent higher) as compared to BIS shovel T-2. Shovel T-3 was having 10.00 percent more length as compared to BIS shovel.

Width: Shovel T-4 measured highest width (54.52 percent higher) followed by Shovel T-3 (3.72 percent higher) as compared to BIS shovel T-2. Shovel T-1 was having 35.83 percent less width as compared to BIS shovel.

Concavity: Shovel T-3 measured having highest concavity (123.48 percent higher) followed by shovel T-1 (120.37 percent higher) as compared to BIS shovel T-2. Shovel T-4 was having 66.68 percent more concavity as compared to BIS shovel.

Diameter of holes: Shovel T-4 measured having lowest diameter of holes (19.46 percent lowest) followed by shovel T-3 (39.94 percent lowest) and shovel T-1 (44.08 percent lowest) as compared to BIS shovel T-2.

Center to center distance: Shovel T-4 measured having lowest center to center distance (1.83 percent lowest) followed by shovel T-3 (3.97 percent lowest) and shovel T-1 (10.51 percent lowest) as compared to BIS shovel T-2.

Rake angle: Shovel T-1 measured having highest rake angle (33.33 percent higher) followed by Shovel T-4 (22.22 percent higher) as compared to BIS shovel T-2. Shovel T-3 was having 4.44 percent more rake angle as compared to BIS shovel.

Conclusion

Shovel T-2 fulfilled the requirement of BIS code whereas all other shovels varied from the standards. Shovel T-4 showed highest variability in terms of length, width, concavity, diameter of holes and center to center distance with respect to BIS standards. Whereas shovel T-3 and T-1 showed the highest variability in terms of concavity and rake angle respectively.

Application of research: Analysis of Reversible Shovels of Fixed Tyne Cultivator

Research Category: Farm Machinery

Abbreviations: CAGR: Compound Annual Growth Rate

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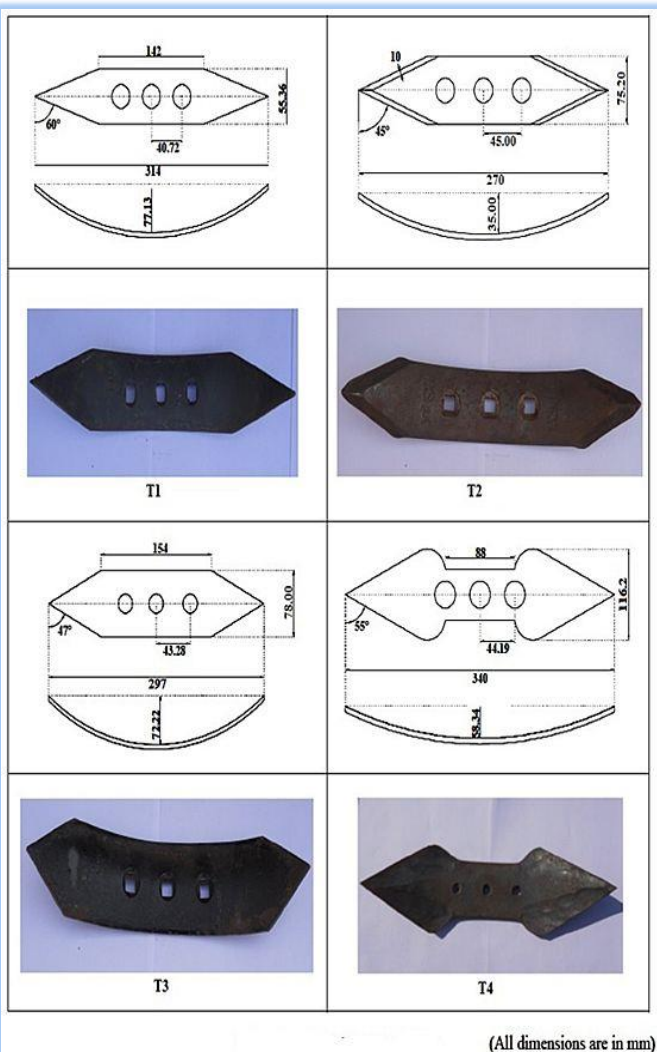


Fig-3 Dimensional details of the four shovels considered in study

Four shovels were identified during the survey. The various dimensions were measured by using digital Vernier calliper, measuring tape and angalometer. The method used for measuring various dimensions is presented in [Fig-2],[Fig-3] gives the dimensional details of the shovels selected for the study.

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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