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## Evaluation of draft ability and physiological response of non-descript bullocks in Latur district

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### Abstract

The importance of livestock in India is based on their production both in terms of milk and draft. Bullocks are the major source of power for cultivating land and carting in rural area. The present study was undertaken with objective to study draft, speed, Horsepower generated and Physiological parameters (Respiration rate, Pulse rate and Body temperature) during various agricultural operations by Non-descript bullocks. The present research was carried out in Latur district during the month of November 2017 to April 2018. The pairing of bullocks was done at the time of their selection with minimum difference in age, body weight and body measurements. The observation on draft, speed, horse power, area covered and physiological parameter viz. respiration rate, pulse rate and body temperature were recorded by conducting trials on harrowing, sowing and hoeing operation for four consecutive days in between 8.00 am to 12 noon. The observations of pull exerted by the bullocks in kg were recorded by using digital dynamometer of 200 kg capacity which was joined at central beam of the implements with the help of rope joining the yoke and the base of the implement so as to record the draft/pull during the working of the implement. The overall mean draft (kg) generated by Non-descript bullock during harrowing, sowing and hoeing operations were 64.41 to 64.85, 64.76 to 65.94 and 41.48 to 42.64 kg, respectively. The average speed exhibited by non-descript bullock were 2.51 to 2.68, 2.49 to 2.54 and 3.34 to 3.36 km/hr. for harrowing, sowing and hoeing operations, respectively. The average horsepower generated by non-descript bullock were 0.59 to 0.63, 0.57 to 0.61 and 0.50 to 0.52 HP for harrowing, sowing and hoeing operations, respectively. The overall mean total area covered by non-descript bullock during harrowing, sowing and hoeing operation were 1107.00 to 1153.65, 1201.77 to 1302.43 and 1154.25 to 1203.31 m<sup>2</sup>/hr, respectively. There was a negatively significant ( $p < 0.01$ ) increases in all the three physiological parameters (respiration rate, pulse rate and body temperature) as compared to their pre-work values. It was concluded that the non-descript bullocks of Latur district are strong powerful in performing of draught characters and they perform as good as the recognized breeds of Deoni and Red Kandhari found in Latur district.

**Keywords:** Draft ability, horsepower, speed, harrowing, hoeing, sowing, dynamometer, non-descript

### Introduction

The importance of livestock in India is based on their production of milk and work. Bullocks are the major source of power for cultivating land and carting in rural area. Draught animals play an important role in Indian agriculture and rural transport system. The term draft refers to an act of moving load by drawing or force required to pull an implement. Draught animal power (DAP) is the important source of renewable energy in which bullocks, buffaloes and camels are the major draught animals for field operations. Information on draft ability of all the major Indian breeds of cattle, buffalo & pack animals including crossbreds is scanty. Major research programmers have been undertaken in milch animals, but draught characteristics of limited breeds have been studied. A present study was conducted to provide suitable information on draft, speed, horsepower generation, area covered and physiological parameters during various agriculture operations by non-descript bullock found in Latur district.

### Material and Methods

The present study was carried out on farmer's fields of Latur district. Two healthy pairs of non-descript bullocks almost age (5 to 7 years), body weight and body measurements were select from farmer fields. Pairing of bullocks was done at the time of selection with minimum difference in the age, body weight and body measurements. Three agricultural operations i.e., harrowing, sowing and hoeing were performed by both the pairs of non-descript bullocks for four consecutive days between 8.00 am to 12.00 noon during the month of November to April.

All the agricultural operations selected for the present study viz. harrowing, sowing and hoeing were performed by blade harrow (bakhar), seed drill and flat blade hoe respectively. The observations of pull exerted by bullock in kilogram were recorded during each operation by using digital dynamometer of 200 kg capacity. The dynamometer was joined at central beam of the implement with the help of rope joining the yoke and the base of the implement record the draft/pull during the working of the implement. The draft exerted by the bullocks to pull the implement was depicted on dynamometer in terms of Kg. The observations were recorded for half an hour interval during four hours of operation and such 8 observations average was considered as the average draft required for each agricultural operations viz., harrowing, sowing and hoeing for that particular day of experiment.

### Angle of pull

The angle pull (Cos A) was calculated from the values (in cm) of height measured between ground level and central point of the yoke where yoke was placed and length (base) between forefront of the implements used and perpendicular point of height at ground. From these two values, the angle of pull recorded from those corresponding values of Cos A were reconfirmed in the table of Logarithm (By Hypotenuse Theorem).

The Values of draft corrected for angle of pull (Cos A) were computed according to the method described by Dubey *et al.* (2007) [2] from equation 1 and 2.

### Physiological Parameters

The observations physiological parameters like respiration rate (no/min), pulse rate (no/min) and body temperature (°F) were recorded according to the standard clinical procedures every day before the start of agricultural operation and immediately after the completion of the work.

### Statistical Analysis

Completely Randomised Design was utilized for analysis of data for agricultural operation. A student "t" test used to test the level of significance of physiological parameter before and after work, recommended by Panse and Sukhatme (1976) [5].

### Results and Discussion

#### Draft (Kg), Speed (km/hr.) and Horsepower (HP) for various agriculture operations

The draft (Kg), speed (km/hr.), horsepower (HP) and area covered (m<sup>2</sup>/hr.) generated for different agricultural operation viz. harrowing, hoeing and sowing nondescript bullock pair I and II are presented in the following headings

**Draft (Kg):** The overall mean draft (kg) generated by non-descript bullock pairs I and II for various agriculture operation is presented in Table 1. The overall mean draft (kg) generated by non-descript bullock pairs I and II for harrowing operation is 64.85 and 64.41 kg, respectively. In present study the overall mean draught exerted by pair I for 1<sup>st</sup> and 3<sup>rd</sup> day was significantly differed with 2<sup>nd</sup> and 4<sup>th</sup> day, but the draft exerted by pair I on 2<sup>nd</sup> and 4<sup>th</sup> days did not differ significantly for harrowing operation. However, the overall draft generated by pair II on 1<sup>st</sup> days was significantly higher as compared to other subsequent three days, whereas draft exerted by pair II on 3<sup>rd</sup> and 4<sup>th</sup> days did not differ

significantly for harrowing operation. The draft generated by both the pair I and II in first day was observed higher and subsequently reduced up to 4<sup>th</sup> day. Similar trend was also observed by Siddiqui *et al.* (2017) [8] in Red Kandhari cattle that draft generated first and second day was increased and subsequently reduced up to 5<sup>th</sup> day.

**Table 1:** Draft (Kg) generated by non-descript bullocks for various operation

Operations Days	Harrowing		Sowing		Hoeing		
	Bullock	Pair I	Pair II	Pair I	Pair II	Pair I	Pair II
1 <sup>st</sup>		65.80 <sup>a</sup>	66.23 <sup>a</sup>	63.35 <sup>c</sup>	65.50 <sup>b</sup>	41.30 <sup>b</sup>	45.44 <sup>a</sup>
2 <sup>nd</sup>		63.64 <sup>b</sup>	64.87 <sup>b</sup>	64.50 <sup>b</sup>	64.33 <sup>c</sup>	40.08 <sup>c</sup>	40.17 <sup>c</sup>
3 <sup>rd</sup>		65.61 <sup>a</sup>	63.24 <sup>c</sup>	66.62 <sup>a</sup>	68.82 <sup>a</sup>	43.97 <sup>a</sup>	44.10 <sup>b</sup>
4 <sup>th</sup>		64.37 <sup>b</sup>	63.30 <sup>c</sup>	64.61 <sup>b</sup>	65.13 <sup>bc</sup>	40.62 <sup>bc</sup>	40.84 <sup>c</sup>
Mean		64.85	64.41	64.76	65.94	41.48	42.64
SE ±		0.34	0.28	0.29	0.27	0.35	0.27
CD		1.08	0.87	0.91	0.86	1.13	0.86

(Means having different superscripts shows significant ( $p < 0.05$ ) differences within a column.)

The overall mean draft (kg) generated by non-descript bullock pairs I and II for sowing operation is 64.76 and 65.94 kg, respectively. In present study the overall mean draught exerted by both pair I and pair II for 3<sup>rd</sup> day was significantly higher as compared to subsequent three days of sowing operation. However, the overall draft generated by pair I was significantly lower on 1<sup>st</sup> days whereas for II pair it was lowest on 2<sup>nd</sup> day of operation. It is noticed that the overall mean draft generated by Non-descript bullocks (64.76 and 65.94) for sowing is found to be quite lower than the draft reported by Yawlikar *et al.* (2003) [13] for Red Kandhari, Deoni, and Hf x Deoni crossbred bullocks.

The overall mean draft (kg) generated by Non-descript bullock pairs I and II for hoeing operation is 41.48 and 42.64 kg, respectively. In present study the overall mean draught exerted by pair I for 3<sup>rd</sup> day was significantly differed with 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> day, but the draft exerted by pair I on 1<sup>st</sup> and 4<sup>th</sup> days did not differed significantly for hoeing operation. However, the overall draft generated by pair II on 1<sup>st</sup> days was significantly differed as compared to other subsequent three days, but the draft exerted by pair II on 2<sup>nd</sup> and 4<sup>th</sup> days did not differ significantly for hoeing operation. These finding are close agreement with Patil (2007) [4] who reported that the average draft khillar during hoeing was 42.34kg.

**Speed (km/hr.):** The overall mean speed (km/hr) generated by non-descript bullock pairs I and II for various agriculture operation is presented in Table 2. The overall mean speed (km/hr.) generated by non-descript bullock pair I and II for harrowing operation were 2.51±0.014 and 2.68±0.013 km/hr., respectively. In present study the overall mean speed exhibited during harrowing by pair I for 4<sup>th</sup> day was significantly higher as compares with 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> day but speed exerted by pair I on 2<sup>nd</sup> and 3<sup>rd</sup> days were at par with each other for harrowing operation. The overall mean speed exhibited by pair II for day 1<sup>st</sup> and 2<sup>nd</sup> was significantly differed with the rest of days. The differences amongst 2<sup>nd</sup> and 4<sup>th</sup> day also recorded significantly different. The similar findings reported by Yawlikar (2001) [12] in HF x Deoni and crossbred bullocks

**Table 2:** Speed (Km/hr) generated by non-descript bullocks for various operation

Operations Days	Harrowing		Sowing		Hoeing	
	Pair I	Pair II	Pair I	Pair II	Pair I	Pair II
Bullock						
1 <sup>st</sup>	2.54 <sup>b</sup>	2.75 <sup>a</sup>	2.34 <sup>b</sup>	2.61 <sup>b</sup>	3.34 <sup>b</sup>	3.32 <sup>a</sup>
2 <sup>nd</sup>	2.41 <sup>c</sup>	2.77 <sup>a</sup>	2.50 <sup>a</sup>	2.46 <sup>c</sup>	3.29 <sup>c</sup>	3.44 <sup>a</sup>
3 <sup>rd</sup>	2.42 <sup>c</sup>	2.65 <sup>b</sup>	2.33 <sup>b</sup>	2.70 <sup>a</sup>	3.42 <sup>d</sup>	3.23 <sup>b</sup>
4 <sup>th</sup>	2.67 <sup>a</sup>	2.54 <sup>c</sup>	2.49 <sup>a</sup>	2.40 <sup>d</sup>	3.31 <sup>a</sup>	3.45 <sup>a</sup>
Mean	2.51	2.68	2.49	2.54	3.34	3.36
SE ±	0.014	0.013	0.011	0.013	0.016	0.015
CD	0.042	0.042	0.034	0.040	0.051	0.046

(Means having different superscripts shows significant ( $p < 0.05$ ) differences within a column.)

The overall mean speed (km/hr) generated by non-descript bullock pair I and II for sowing operation were 2.49 and 2.54 km/hr, respectively. In present study the overall mean speed exhibited by pair I on 2<sup>nd</sup> and 4<sup>th</sup> day was significantly higher than the rest of days, whereas the differences amongst the 1<sup>st</sup> and 3<sup>rd</sup> day did not significantly differ. The overall mean speed exhibited by pair II on 3<sup>rd</sup> was significantly differed with rest of days, however the differences amongst the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> day were significantly differed. The similar findings reported by Yawlikar (2003) [13] in Red Kandhari, Deoni and HF x Deoni crossbred bullocks.

The overall mean speed (km/hr) generated by non-descript bullock pair I and II for hoeing operation were 3.34 and 3.36 km/hr, respectively. In present study the overall mean speed exhibited by pair I on 3<sup>rd</sup> day was significantly higher than the rest of days, whereas speed exerted by pair I on 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> days also differed significantly for hoeing operation. The overall mean speed exhibited by pair II on 2<sup>nd</sup> and 4<sup>th</sup> day was significantly differed with rest of days, however the differences amongst the 1<sup>st</sup>, and 3<sup>rd</sup> day were significantly differed for hoeing operation. It is noticed that the overall

mean speed exhibited by non-descript bullocks (3.34 and 3.36 km/hr) for hoeing is found to be lower than the speed reported by Patil (2007) [4] in Khillar bullocks was 3.77 km/hr.

### Horsepower (HP)

The overall horsepower (HP) generated by non-descript bullock pairs I and II for various agriculture operation is presented in Table 3. The horsepower (HP) generated by non-descript bullock pair I and II for harrowing operation were 0.59 and 0.63 HP, respectively. In present study the overall horsepower generated by pair I on 4<sup>th</sup> day was significantly differed than the rest of days however the differences amongst the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> day were significantly differed for harrowing operation and the overall mean horsepower generated by pair II for 1<sup>st</sup> and 2<sup>nd</sup> day significantly differed than the rest of days whereas horsepower generated on 3<sup>rd</sup> and 4<sup>th</sup> was significantly differed for harrowing operation. these finding are in close comparable with the findings of other indigenous breeds such as sahiwal bullocks as 0.627 HP for harrowing reported by Singh *et al.* (1970).

**Table 3:** Horsepower (hp) generated by non-descript bullocks for various operation

Operations Days	Harrowing		Sowing		Hoeing	
	Pair I	Pair II	Pair I	Pair II	Pair I	Pair II
Bullock						
1 <sup>st</sup>	0.61 <sup>b</sup>	0.67 <sup>a</sup>	0.54 <sup>c</sup>	0.63 <sup>b</sup>	0.50 <sup>b</sup>	0.55 <sup>a</sup>
2 <sup>nd</sup>	0.56 <sup>c</sup>	0.66 <sup>a</sup>	0.59 <sup>a</sup>	0.58 <sup>c</sup>	0.48 <sup>c</sup>	0.51 <sup>b</sup>
3 <sup>rd</sup>	0.58 <sup>d</sup>	0.61 <sup>b</sup>	0.57 <sup>b</sup>	0.68 <sup>a</sup>	0.55 <sup>a</sup>	0.52 <sup>b</sup>
4 <sup>th</sup>	0.63 <sup>a</sup>	0.59 <sup>c</sup>	0.59 <sup>a</sup>	0.57 <sup>d</sup>	0.49 <sup>bc</sup>	0.51 <sup>b</sup>
Mean	0.59	0.63	0.57	0.61	0.50	0.52
SE ±	0.005	0.005	0.004	0.005	0.004	0.005
CD	0.015	0.015	0.014	0.015	0.014	0.014

(Means having different superscripts shows significant ( $p < 0.05$ ) differences within a column.)

The horsepower (HP) generated by non-descript bullock pair I and II for sowing operation were 0.57 and 0.61 HP, respectively. In present study the overall horsepower generated by pair I on 2<sup>nd</sup> and 4<sup>th</sup> day was significantly higher than the rest of days however the differences amongst the 1<sup>st</sup> and 3<sup>rd</sup> day were also significantly differed for sowing operation. Whereas the overall mean horsepower generated by pair II for 3<sup>rd</sup> day significantly higher than the rest of days whereas horsepower generated on all 1<sup>st</sup> to 4<sup>th</sup> days also significantly differed each other for sowing operation. These findings are close agreement with the findings of Yawlikar *et al.* (2003) [13].

The horsepower (HP) generated by non-descript bullock pair I and II for hoeing operation were 0.50 and 0.52 HP, respectively. In present study the overall horsepower generated by pair I on 3<sup>rd</sup> day was significantly higher than the rest of days however the differences amongst the 1<sup>st</sup> and 4<sup>th</sup> day were significantly differed for hoeing operation and

the overall mean horsepower generated by pair II for 1<sup>st</sup> day significantly differed than the rest of days whereas horsepower generated on 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> days did not significantly differed for hoeing operation. It is noticed that the overall mean horsepower generated by Non-descript bullocks (0.50 and 0.52HP) for hoeing is found to be lower than the horse power generated by Khillar bullocks reported by Patil (2007) [4] during hoeing was 0.60HP.

### Area covered (m<sup>2</sup>/hr.)

The overall area covered (m<sup>2</sup>/hr) by non-descript bullock pairs I and II for various agriculture operation is presented in Table 4. The overall mean area covered (m<sup>2</sup>/hr) by non-descript bullock pairs I and II during harrowing operation were 1107.00 and 1153.65 m<sup>2</sup>/hr, respectively. In present study the overall mean area covered by pair I on 4<sup>th</sup> day was significantly differed than the rest of days but did not significantly differ on 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> day and the overall mean



area covered by pair II for 1<sup>st</sup> and 2<sup>nd</sup> day was significantly differed as compared to subsequent other two days of harrowing operation. Present findings are in close agreement with the findings reported by Atakare (2009) <sup>[1]</sup> who reported the area covered during harrowing for Deoni bullocks was 1194 to 1392m<sup>2</sup>/hr.

**Table 4:** Area covered (m<sup>2</sup>/hr) generated by non-descript bullocks for various operation

Operations Days	Harrowing		Sowing		Hoeing	
	Bullock Pair I	Bullock Pair II	Bullock Pair I	Bullock Pair II	Bullock Pair I	Bullock Pair II
1 <sup>st</sup>	1098.00 <sup>b</sup>	1207.37 <sup>a</sup>	1120.60 <sup>b</sup>	1348.75 <sup>b</sup>	1174.50 <sup>a</sup>	1163.62 <sup>b</sup>
2 <sup>nd</sup>	1039.50 <sup>b</sup>	1226.87 <sup>a</sup>	1300.00 <sup>a</sup>	1239.87 <sup>a</sup>	1073.25 <sup>b</sup>	1305.00 <sup>a</sup>
3 <sup>rd</sup>	1084.50 <sup>b</sup>	1106.25 <sup>c</sup>	1105.00 <sup>b</sup>	1436.50 <sup>a</sup>	1226.25 <sup>a</sup>	1011.37 <sup>c</sup>
4 <sup>th</sup>	1206.00 <sup>a</sup>	1074.12 <sup>b</sup>	1281.50 <sup>a</sup>	1184.62 <sup>c</sup>	1143.00 <sup>ab</sup>	1333.27 <sup>a</sup>
Mean	1107.00	1153.65	1201.77	1302.43	1154.25	1203.31
SE ±	27.98	12.00	21.96	23.29	30.97	30.45
CD	87.17	37.38	68.42	75.57	96.49	94.88

(Means having different superscripts shows significant ( $p < 0.05$ ) differences within a0020column.)

The overall mean area covered (m<sup>2</sup>/hr) by non-descript bullock pairs I and II during sowing operation were 1201.77 and 1302.43 m<sup>2</sup>/hr, respectively. In present study the overall mean area covered by pair I on 2<sup>nd</sup> and 4<sup>th</sup> day was significantly higher than the rest of days but did not significantly differ on 1<sup>st</sup> and 3<sup>rd</sup> day and the overall mean area covered by pair II for 3<sup>rd</sup> day was significantly differed as compared to other subsequent days of sowing operation. These findings are in close agreement with findings of Yawlikar (2001) <sup>[12]</sup>.

The overall mean area covered (m<sup>2</sup>/hr) by non-descript bullock pairs I and II during hoeing operation were 1154.25 and 1203.31 m<sup>2</sup>/hr., respectively. In present study the overall mean area covered by pair I on 1<sup>st</sup> and 3<sup>rd</sup> day was significantly differed on 2<sup>nd</sup> day and the overall mean area covered by pair II for 2<sup>nd</sup> and 4<sup>th</sup> day was significantly differed as compared to other subsequent days of hoeing operation. These findings are in close agreement with findings of Patil (2007) who observed that the overall mean for area covered by Khillar bullocks during hoeing was 1242.40 m<sup>2</sup>/hr.

#### Physiological Parameters of Non-descript Bullocks during work performance

The physiological parameters like respiration rate, pulse rate and body temperature of each non-descript bullocks were recorded before start and immediately after completion of each operation. It was necessary to noted the changes take place in these parameters due to the impact of draft/horse power generated by the bullock after completion of the work.

#### Respiration rate of non-descript bullocks before and after various draught operation

The overall mean respiration rate (No/min) of each non-descript bullocks were recorded before and after harrowing, sowing, and hoeing operation are presented in Table 5.

The overall mean respiration rate before and after harrowing operation recorded for non-descript bullock was 21.2 and 44.41 for I-A, 21.49 and 45.57 for I-B, 22.41 and 46.83 for II-A and 22.08 and 46.24 for II-B bullock (per minute), respectively. The overall mean respiration rate before and after sowing operation recorded for non-descript bullock were 21.08 and 43.58 for I-A, 22.21 and 43.99 for I-B, 22.32 and

44.41 for II-A and 21.08 and 43.24 for II-B bullock (per minute), respectively. The overall mean respiration rate before and after hoeing operation for non-descript bullock was 21.16 and 38.58 for I-A, 21.41 and 39.49 for I-B, 22.49 and 41.58 for II-A and 21.66 and 40.41 for II-B bullock (per minute), respectively. The respiration rate before and after harrowing, sowing and hoeing operation was negatively significant for bullock No. I-A, I-B, II-A and II-B as revealed by "Student t-test".

In the present study the respiration rates recorded before different draught operations ranged between 20 to 22 per minute whereas after operations it ranged between 36 to 46 per minute. The increase in respiration rate before and after work was due to increased rate of metabolism to provide adequate energy to the working muscles. Similar findings were also reported by Yawlikar (2001) <sup>[12]</sup>, Atakare (2009) <sup>[1]</sup> and Shelke (2009) <sup>[7]</sup> reported that the significance increase in the respiration rate before and after ploughing, harrowing and sowing operation.

#### Pulse rate of non-descript bullocks before and after various draught operations

The overall mean pulse rate (No/min) of each non-descript bullocks was recorded before and after harrowing, sowing and hoeing are presented in Table 5.

The overall mean pulse rate of bullock before and after harrowing operation was 53.66 and 74.74 for I-A, 54.58 and 75.41 for I-B, 55.36 and 77.08 for II-A, 54.83 and 76.24 (per/min) for II-B bullocks, respectively. The overall mean pulse rate of bullock before and after sowing operation was 50.08 and 71.16 for I-A, 51.74 and 72.41 for I-B, 52.08 and 71.49 for II-A, 50.24 and 70.08 (per/min) for II-B bullock, respectively. The overall mean pulse rate of bullock before and after hoeing operation was 51.49 and 72.58 for I-A, 52.58 and 73.74 for I-B, 53.66 and 74.83 for II-A, 52.49 and 73.58 (per/min) for II-B bullocks respectively. The pulse rate before and after the each operation differ negatively significantly ( $p < 0.01$ ) for all the bullock No. I-A, I-B, II-A and II-B as revealed by the "Student t-test". In the present investigation the pulse rates recorded before different draught operations ranged between 48 to 55per minute whereas after operation it ranged between 68 to 77 per minute. The increase in pulse rate represents a rise in cardiac activities to fulfill the increased demand of oxygen during work.

Similar findings were also reported by Similar findings were also reported by Yawlikar (2001) <sup>[12]</sup>, Atakare (2009) <sup>[1]</sup> and Shelke (2009) <sup>[7]</sup> revealed that the significance increasing in the average pulse rate after the different operations.

#### Body temperature of non-descript bullocks before and after various draught operations

The overall mean body temperature (°F) of individual non-descript bullocks recorded before and after operations like harrowing, sowing and hoeing are presented in Table 5.

The overall mean body temperature of non-descript bullock before and after harrowing operation was 99.57 and 102.22 for I-A, 99.70 and 102.46 for I-B, 100.12 and 102.50 for II-A, 99.92, and 102.27 °F for II-B bullocks, respectively. The overall mean body temperature of non-descript bullock before and after sowing operation was 99.76 and 101.05 for I-A, 99.95 and 101.11 for I-B, 100.04 and 100.17 for II-A, and 100 and 101.29°F for II-B bullocks, respectively. The overall mean body temperature of non-descript bullock before and

after hoeing operation was 99.57 and 102.10 for I-A, 99.53 and 102.25 for I-B, 100.07 and 102.42 for II-A, and 100.00, and 102.10<sup>0</sup>F for II-B bullocks, respectively. The Body temperature before and after the harrowing, sowing and hoeing operation differ negatively significant ( $p < 0.01$ ) for all the bullock No. I-A, I-B, II-A and II-B as revealed by the "Student t-test".

The increase in the body temperature of non-descript bullocks after completion of the different draught operations viz. harrowing, sowing and hoeing observed in the present investigation are compare with result reported by Yawlikar

(2001) [12] for Red Kandhari, Deoni and HF x Crossbred. Atakare (2009) [1] for Deoni and Shelke (2009) [7] for Red Kandhari observed the increase in body temperature during various operation.

In the present study it is observed that there was uniform increasing in the body temperature for different agriculture operation i.e. harrowing, sowing and hoeing operations. The increase in body temperature before and after work might be due to increased heat stress on account of increased lactic acid production by the muscles and its removal by oxidative process (Yadav 2001) [11].

**Table 5:** Physiological parameters of non-descript bullocks before and after for various operation

Bullocks	Mean Respiration (number/min)		"t" value	Mean Pulse rate (number/min)		"t" value	Mean Body temperature ( <sup>0</sup> F)		"t" value
	Before	After		After	Before		After	Before	
	<b>Harrowing</b>			<b>Harrowing</b>			<b>Harrowing</b>		
I-A	21.24	44.41	-107.46**	53.66	74.74	-32.78**	99.57	102.22	-12.74**
I-B	21.49	45.57	-65.15**	54.58	75.41	-33.74**	99.70	102.46	-35.05**
II-A	22.41	46.83	-71.19**	55.36	77.08	-77.59**	100.12	102.50	-37.74**
II-B	22.08	46.24	-24.03**	54.83	76.24	-74.60**	99.92	102.27	-36.40**
	<b>Sowing</b>			<b>Sowing</b>			<b>Sowing</b>		
I-A	21.08	43.58	-104.98**	50.08	71.16	-133.45**	99.76	101.05	-12.95**
I-B	22.21	43.99	-125.22**	51.74	72.41	-151.08**	99.95	101.11	-17.45**
II-A	22.32	44.41	-77.70**	52.08	71.49	-61.68**	100.04	101.17	-20.17**
II-B	21.08	43.41	-54.70**	50.24	70.08	-50.17**	100.0	101.29	-45.16**
	<b>Hoeing</b>			<b>Hoeing</b>			<b>Hoeing</b>		
I-A	21.16	38.58	-50.50**	51.49	72.58	-74.81**	99.57	102.10	-14.83**
I-B	21.41	39.49	-63.29**	52.58	73.74	-53.65**	99.53	102.25	-33.77**
II-A	22.49	41.58	-118.17**	53.66	74.83	-48.03**	100.07	102.42	-81.40**
II-B	21.66	40.41	-90.32**	52.49	73.58	-85.18**	100.0	102.10	-50.41**

## Conclusion

The present study indicated draughts generated by non-descript bullocks during sowing operation are higher than harrowing and hoeing operation. The speed (km/hr) during hoeing operation is higher than sowing and harrowing operation. The horsepower (HP) generated during harrowing operation are higher than sowing and hoeing operation. The area covered (m<sup>2</sup>/hr) during sowing operation are higher than hoeing and harrowing operation. The overall picture of physiological parameter in terms of respiration rate, pulse rate and body temperature of non-descript bullocks when exposed to different draught operations like harrowing, sowing and hoeing has resulted into a moderate alteration increase in these parameters may lead to the conclusion that non-descript bullocks are well suited for different draught operations. Which gives to concrete conclusion non-descript bullocks of Latur district are strong powerful in performing draught characters and they perform as good as the recognized breeds of Deoni and Red Kandhari found in Latur district.

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