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Design and development of pedal operated drip lateral winder

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Abstract

In present study, pedal operated lateral winder mainly consists of Main frame, Sprocket and Chain, Shaft, Fixed wheel, Seat etc. The machine was design and developed at Dadasaheb Mokashi College of Agricultural Engineering and Technology, Rajmachi. The 100 m lateral with 1.30 m spacing between two laterals spread over 130 m² area. The average time required for retrieving 100 m lateral by pedal operated drip winder was found to be 1.145 min while manually, it takes 1.40 min. Similarly, 150 and 200 m length of lateral was spread over 144 and 255 m² areas for testing, respectively. Machine took 1.525 min and 2.31 min to retrieve the lateral for 150 and 200 m length of lateral, respectively. Also, for the same lateral, manually it took 2.30 and 3.205 min to retrieve the lateral, respectively. Average capacity of manually was 60, 69.23 and 60 meter per minute for 1st, 2nd and 3rd reading respectively. Similarly, average capacity of pedal operated drip lateral winder was 79.64, 80.35 and 79.99 meter per minute for 1st, 2nd and 3rd reading respectively. The average capacity of manually and pedal operated lateral winder was found to be 63.08 and 79.99 meter per minute. It was developed by locally available material with minimal cost of Rs. 4800/-.

Keywords: Average capacity, pedal operated, lateral winder

1. Introduction

In scenario of human history, various kind of energy used by human being i.e. mechanical, electrical, human and animal etc. But, human energy is the prim energy utilized in evaluation of human kind. It has been applied through the use of the hand (arm), foot (leg) and back. Also, today in this world every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure (Sandeep, *et al.* 2017) [7]. Everyone cannot afford this kind of investment and expenditure. Pedal power is the transfer of energy from a human source through the use of a foot pedal and crank system. This technology is most commonly used for transportation and has been used to propel bicycles for over a hundred years. Less commonly pedal power is used to power agricultural and hand tools and even to produce electricity (Kamble, *et al.* 2016) [4]. There were various kinds of pedal operated domestic applications such as Washing machine, Cell phone charging, wet grinding & Indoor cycling for exercise etc. developed which are economically efficient. The pedal operated drip winder can be used in remote places where electricity is irregular or insufficient. It is designed as a portable one. It can be operated without any external energy like fuel or electricity supply. The main benefit from this project is to understand the fabrication and development of most beneficial pedal operated drip lateral in farmer's point of view and industrial purpose.

2. Materials and Methods

2.1 Study area

The pedal operated drip lateral winder was fabricated in the Ogalewadi, Karad. While, performance evolution was conducted on the farm of Dadasaheb Mokashi College of Agricultural Engineering and Technology, Rajmachi, Karad.

2.2 Components of Pedal operated drip lateral winder

2.2.1 Pedal operated drip lateral winder

The main components of pedal operated drip lateral winder are fixed wheel, main frame, sprocket and chain, shaft, pedal and seat etc.

2.2.2 Base frame

The base frame was act as skeleton of pedal operated drip lateral winder. The entire assembly of machine was mounted on it. It was made of mild steel with rectangular in shape having dimensions of 1700 × 490 × 10 mm.

2.2.3 Sprocket and Chain

Sprocket and chain were used to convey mechanical power from one place to another i.e. Wheel of the vehicle. The chain drives consist of Outer Plates or Pin Link plates, inner plates or roller link plates, pin, bushes and roller. A pin passes through the bush, secured the holes of the roller between the two ends of the chain. The Rollers are free to rotate on the bush which protects the sprocket wheel teeth against wear. The pins, bushes and rollers are made of alloy steel. The gear ratio of 1:1 was used in this machine.

2.2.4 Shaft

A drive shaft, driving shaft, propeller shaft (prop shaft), or Cardin shaft were a mechanical components used for transmitting torque and rotation. Usually, these are used to connect other components of a drive train, which cannot be connected directly because of distance or the need to allow relative movement between them. To allow variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate with one or more universal joints, jaw couplings or rag joints and sometimes a splined joint or prismatic joint. Shaft is mechanical component of pedal used to transmit torque and rotary motion to sprocket.

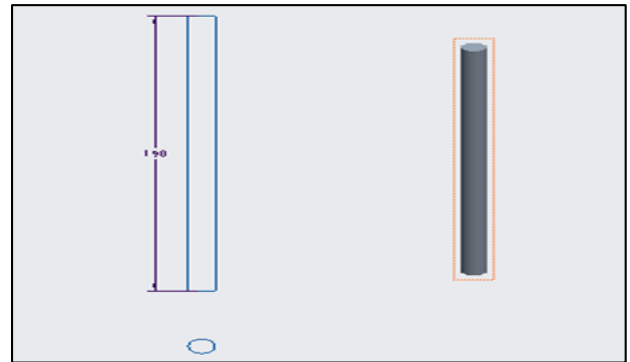


Plate 3: Shaft

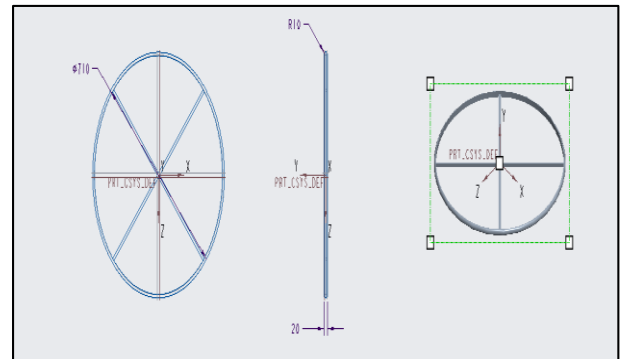


Plate 4: Fixed wheel

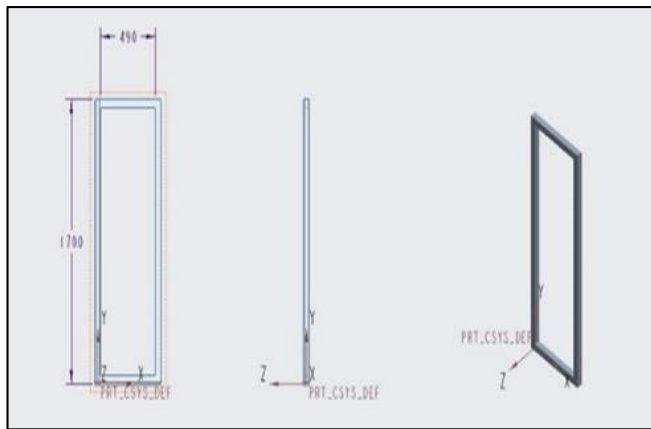


Plate 1: Base frame



Plate 5: Pedal



Plate 2: Sprocket & chain

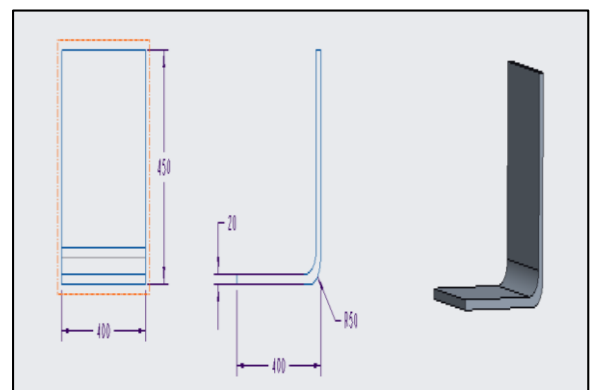


Plate 6: Seat

2.2.5 Fixed wheel: The wheels used in this machine are made of cast iron. The main function of wheel was to carry and collect the lateral. One wheel used to fix to the major shaft in the front having diameter 710 mm.

2.2.6 Pedal: Pedal was connected to fixed wheel through sprocket and chain. On rotation of pedal, it transmits circular motion to wheel, which keeps in rotary motion.

2.2.7 Seat: A seat is intended to help the sit back and ride ordinarily in the semi learned back position. In this design the wooden seat has been utilized having the dimension of 400 × 450 × 400 mm.

2.3 Process of retrieve lateral from farm

Initially, the Pedal-operated Drip Lateral winding machine was fixed on a stable support structure. Then, the drip lateral hose is connected to the inlet (a small hole on wing) of the machine. Further, the user starts pedaling the machine by pushing the pedal mechanism. As soon as the pedal mechanism starts rotating, not only the shaft attached to paddles starts rotating but also main wheel. As the wheel rotate on the shaft, grasp the drip lateral hose and wind it onto a reel. The winding process continues until the desired length of the hose is wound onto the reel. It can be stopped by releasing the pedal mechanism. Detail procedure was given below in fig.

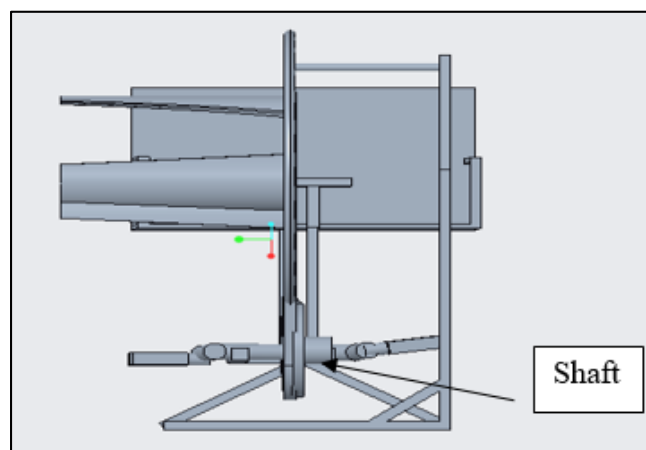
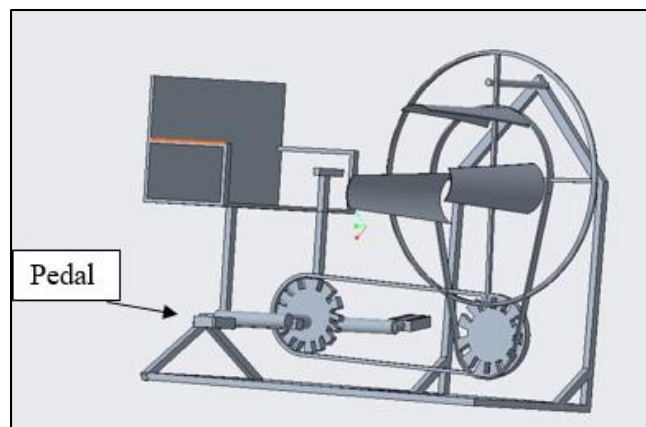
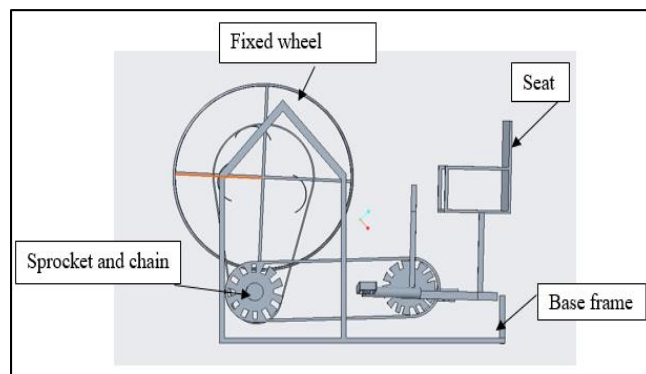


Plate 7: Views of pedal operated drip lateral winder

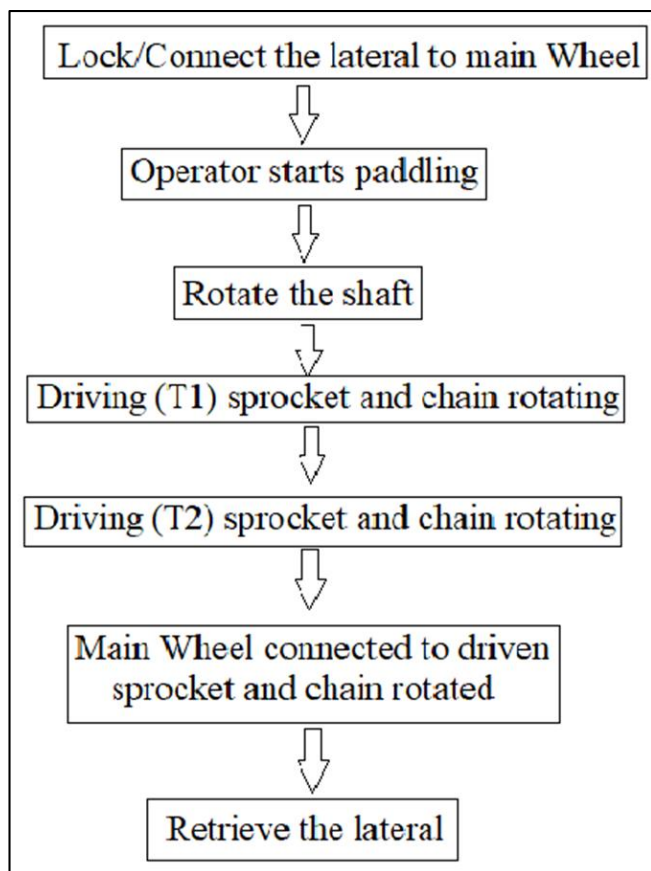


Fig 1: Process of retrieval of lateral from farm



Plate 8: Pedal operated drip lateral winder

Table 1: Specifications of pedal operated drip lateral winder

Sr. No.	Particulars	Parameter	Specification
1.	Name of equipment	Pedal operated drip lateral winder	
2.	Type of action and its Power source	Action	Rotational type
		Power source	Pedal operated
3.	Overall dimensions	Length	1700 mm
		Height	1300 mm
		Width	490 mm
4.	Base frame	Material of construction	Galvanized iron
		Length	1700 mm
		Width	490 mm
5.	Main wheel	Material of construction	Mild steel
		Dia. Of wheel	710 mm
6.	Shaft	Dia. Of shaft	30 mm
		Length of shaft	190 mm
7.	Seat	Material of construction	Wood
		Length	450 mm
		Width	400 mm
		Height	400 mm
8.	Sprocket	Dia of large sprocket	180 mm
		Dia of small sprocket	90 mm
		Teeth of large sprocket	44
		Teeth of small sprocket	14

2.4 Cost estimation for pedal operated drip lateral winder

Whole project were coasted to rupees 4800/- approx. While, the cost of different components such as base frame, main wheel, shaft, pedal, sprocket and chain, seat etc. were given below in Table.

Table 2: Cost economics of pedal operated drip lateral winder

Sr. No.	Component name	Value, Rs.
1	Base frame	500/-
2	Main wheel	1500/-
3	Sprocket and chain	800/-
4	Pedal	250/-
5	Seat	400/-
6	Fabrication cost	1000/-
7	Operational cost	300/-
8	Maintenance	50/-
	Total Cost	4800/-

3. Results and Discussions

The evaluation of the pedal operated drip lateral winder had

been performed in the different size of fields like 130, 144, 255 m². Testing of machine was done on field area of Dadasaheb Mokashi college of Agriculture Engineering and Technology Rajmachi, Karad. Details of testing results were given as below.

The 100 m lateral with 1.30 m spacing between two laterals spread over 130 m² area. The average time required for retrieving 100 m lateral by pedal operated drip winder was found to be 1.145 min while manually, it takes 1.40 min. Similarly, 150 and 200 m length of lateral was spread over 144 and 255 m² areas for testing, respectively. Machine took 1.525 min and 2.31 min to retrieve the lateral for 150 and 200 m length of lateral, respectively. Also, for the same lateral, manually it took 2.30 and 3.205 min to retrieve the lateral, respectively. Average capacity of manually was 60, 69.23 and 60 meter per minute for 1st, 2nd and 3rd reading respectively. Similarly, average capacity of pedal operated drip lateral winder was 79.64, 80.35 and 79.99 meter per minute for 1st, 2nd and 3rd reading respectively.

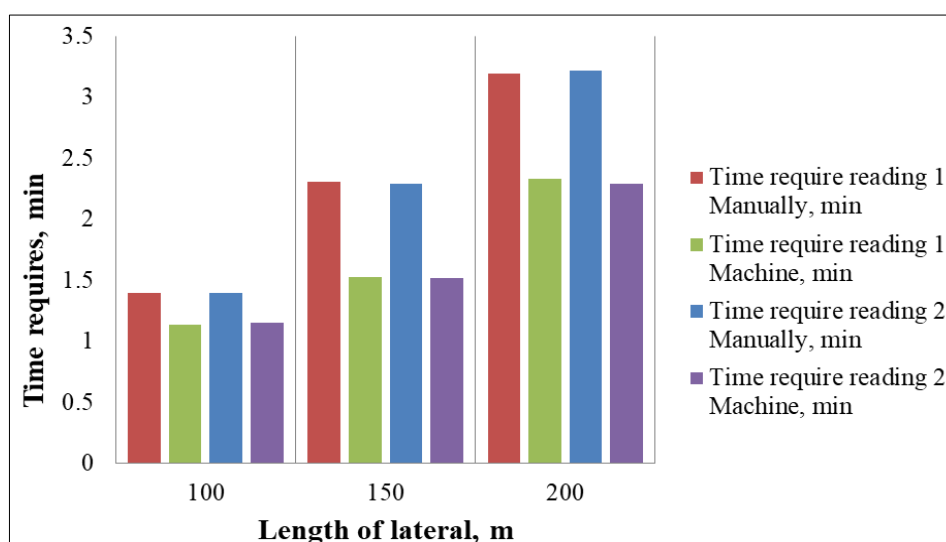
**Fig 2:** Performance of pedal operated drip lateral winder

Table 3: Performance of pedal operated drip lateral winder

Sr. No.	Size of Plot, m ²	Length of lateral, m	Time require Reading 1		Time require Reading 2		Average Time required	
			Manually, min	Machine, min	Manually, min	Machine, min	Manually, min	Machine, min
1.	230	100	1.40	1.14	1.40	1.15	1.40	1.15
2.	144	150	2.31	1.53	2.29	1.52	2.30	1.53
3.	255	200	3.19	2.33	3.22	2.29	3.21	2.31
Average		150	150 sec	113 Sec	130 sec	112 sec	150 sec	113 sec
Average Capacity, meter per min			60	79.64	69.23	80.35	60	79.99
Average capacity manually, m/min			63.08		Average capacity by machine, m/min		79.99	

Net saving time = (Total manually time require) – (Total pedal time require)
= (1.40 + 2.30 + 3.20) – (1.15 + 1.52 + 2.30)
= 6.9 – 4.9 min
= 2 min

The total saving time for 542 m² area was 2 min.
Similarly, then net saving time for 1 ha will be 108 min.

4. Conclusion

Various drip lateral winder having different capacity, type of operation and dimension available in market. But, pedal operated drip winder requires low cost and maintenance than other. It not only requires less labour (max. 2) but also time as compare to manually drip winding. The average capacity of manually and pedal operated lateral winder was 63.08 and 79.99 meter per minute. This is also profitable by 16 meter per minute. It was developed by locally available material with minimal cost of Rs. 4800/-. Hence, it can be adopt and develop by anyone anywhere.

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