Performance Evaluation and Economic Analysis of Paddy Thresher

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Abstract

Natural disasters frequently compel farmers to lose their crops because they lack the customary old design of threshing mechanism. looking into every area of post-harvest losses and finding ways to make life easier for farmers, especially small farmers. A power-operated paddy thresher Mk-I was created, and after some modifications, such as the addition of rocking wheels for transportation and a poly sheet cover for the Mk-I, a paddy thresher Mk-II was created, and its operating parameters were discovered to be more similar to those of the standard one. This paddy thresher included a mechanism for winnowing as well. The performance evaluation was carried out on Sri Ram, 6444 and Brevant of paddy varieties available locally. The paddy thresher Mk-I had the threshing efficiency, cleaning efficiency, percentage of un-threshed grain and threshing input capacity as 90.03 %, 95.94 %, 9.67 %, and 1145.93 kg/h respectively. While the paddy thresher Mk-II had the threshing efficiency, cleaning efficiency, percentage of un-threshed grain and threshing input capacity as 94.05%, 95.70 %, 5.95 % and 970.33 kg/h respectively.

Keywords: Paddy, paddy varieties, paddy thresher machine, Paddy-6444, Sri Ram and Brevant

Introduction

In different climates and altitudes throughout India, rice is cultivated as a staple crop. Different soil types, rainfall patterns, temperature swings, water availability, and other agroclimatic factors all affect how long the growing season lasts. Because of the favourable climate in the country's south and east, rice may be grown there all year long. India's southern and eastern states typically harvest two to three crops per year, while the western and northern states experience heavy winter rainfall and high summer precipitation. From May to November, only one rice crop is grown in this region. Autumn, winter, and summer are the three seasons in India for sowing paddy. Since autumn paddy is sometimes referred to as pre-kharif paddy, the three seasons have been maintained in accordance with when it is harvested. September to October is when pre-kharif paddy is harvested.

Pre-kharif paddy is sown from May to August, however the precise sowing date varies from state to state according on the climate and rainfall patterns. Bhadai in Bihar, Beali in Odisha, Aus in West Bengal, Ahi in Assam, Sornawari in Tamil Nadu, and Virippu in Kerala are the names given to the autumn rice crop. In this season, paddy is grown to a percentage of about 7%. Varieties sown during this season last 90 to 110 days. Winter rice is grown most extensively during the Kharif season in IndiaAgahani, Sali, Sarrad, Aman, and Sarava are the names given to winter rice in Bihar and Uttar Pradesh, Assam, Orissa, West Bengal, Andhra Pradesh, and Telangana, Tamil Nadu, and Kerala, respectively. The majority of the medium- to long-duration types are sown during this season, which accounts for about 84% of the nation's cultivation. Rabi crops include paddy, which is planted in the summer. In Bihar, it's known as Garma, while it goes by the names Boro in Assam and West Bengal, Dalua in Orissa, Dalwa in Andhra Pradesh, Navarai in Tamil Nadu, and Punja in Kerala. The months of November through February are when summer paddy is sown, and the months of March through June are when it is harvested. Only 9% of the acreage is used for the summer rice crop, which is when varieties with short maturation times are sown.

Due to paddy's physical versatility, it can be grown in a wide range of soil types and climatic circumstances, including both acidic and alkaline soil. Paddy is farmed in India from below sea level in the Kuttanad region of Kerala to 2,000 metres above sea level in Jammu and Kashmir, the Himachal Pradesh hills, Uttarakhand, and NE states. Five zones—the North Eastern, Eastern, Northern, Western, and Southern zones—can be used to categorise the rice-growing land in India. The primary crop in Uttar Pradesh is paddy, which is grown on an area of 5.90 million hectares and contributes 13.5% of the production for the entire nation. India engages in extensive international trade in rice. India is the source of Basmati rice and other types. In descending order, West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Chhattisgarh, Odisha, Assam, and Karnataka are the 10 states in India that produce paddy.

Numerous varieties of rice are grown in India depending on environments and climatic conditions suiting to the varieties. Now-a-days hybrid varieties are more popular. Some of the local and hybrid varieties used for the performance evaluations are namely paddy-6444, Shree Ram and Brivant. The paddy-6444 is India's highest selling hybrid rice, having consistently 25-30% higher yield than the varieties of same duration (135-140 days), high productive tiller per plant, more grain per panicle, wider adaptability, highly suitable to direct seeded rice system, more than 70% milling and notified by Government of India. The morphological characters of Shree Ram seeds are namely plant height (90-95 cm), duration (120-125 days), grain type (medium slender, fine), tolerant to stem borer and plant hopper, suited for irrigated areas during Kharif season, high yields and good grain quality, fetches high market price due to fine grain, good cooking quality, tolerant to major pests, area of adaptability – UP, Bihar, MP, Chhattisgarh, AP, TN and Karnataka, high milling recovery over 70%. The distinct characteristics of Jai Shree Ram paddy variety are namely – higher yielder (45-55 Qtls/ha), number of ear head 10 to 12, 400 spikelets per panicle, good plant height (150cm), lengthy spikes 8 to 10 inches, maturity period 130-135 days, short and thin grains, good cooking quality and taste, resistance to biotic and abiotic stress, synchronous maturity. Likewise, Brivant hybrid paddy variety is locally popular because of similar characteristics.

The farm machinery component known as a threshing machine is used to separate paddy grain from straw. Paddy threshing was previously done by hand, which required a great deal of effort and time. The difficulty of farm labour has been decreased as a result of the mechanisation of the threshing process. The first threshing machine was created by the Scottish engineer Andrew Meikle, and subsequent improvements to mechanical reapers and threshers were made up to the 19th century, allowing grain to be produced at a low cost. The process of threshing now begins with a cylinder and concave, which rotates at a high speed of roughly 500 rpm and contains sharp serrated bars that continue to beat the paddy and separate the grain from straw. The concave curve is made to mirror the cylinder's shape and is used to contain the beaten grain while separating it from the straw and chaffWhen a fan is readily installed, a basic cylindrical drum known as a threshing tool that has wire loop rotates with power attachments separates the grain from the stalk panicles being stroked between the wire loops. Such threshers are particularly popular since local artisans can simply create them for small farm farmers.

In order to evaluate the effectiveness of the threshers, various designs and developments have been made. In this context, some researchers have worked on it and provided their findings, such as Cain and Holmes (1977), who developed a machine for soybeans similar to a paddy thresher and evaluated it on the impact damage of rice grains and came to the conclusion that the impact damage depends on grain moisture and velocity of impact. According to Bartsch et al. (1978), dynamic events happen during harvesting in the threshing and conveying procedures, frequently involving a significant momentum exchange when grain collides with machine parts. According to Paulsen (1979), the particle velocity just prior to impact and the hardness of the surface against which the impact occurs are the common causes of damage in all grain-management studies. The proportion of split and finer particles rose as impact velocity increased. Low post-impact division % seeds exhibited good germination rates. A rice producer should be concerned with threshing and separation efficiency while avoiding excessive impact damage to the grain, according to Nave (1979). The creation of rotary threshing equipment is the outcome of efforts to decrease threshing losses while increasing efficiency. In addition to developing a machine for threshing rice, Newberg et al. (1980) assessed the harm done to the rice grains by rotational and traditional threshing processes. Four circumferential (peripheral) velocities were evaluated on three different combines in the field. At the same peripheral speed, conventional cylinders had a much higher split percentage than single-rotor or double-rotor threshing systems. For all three threshing systems, the proportion of segmentation grew as the peripheral threshing speed did. However, compared to traditional cylinder threshing, the rise in division was less using the rotating threshing method. At the lowest rotor speeds, separation loss with rotary combines was much higher. The effectiveness of the rasp bar and peg-tooth threshing drum of the axial flow thresher for rice crop was compared by Vejasit (1995). The findings showed that the amount of grain fed into the threshing unit was the same for both cylinders at all cylinder speeds and feed rates. The plot combine for threshing paddy crop was tested by Rani et al. (2001), who found that the maximum threshing efficiency was 97.2% at 8.9% wet bulb grain moisture content and 10.1 metre per second cylinder speed. Weerasooriya G.V.T.V. et al. (2011) evaluated the field performances and economics of four-wheel tractor driven high-capacity combined paddy thresher and monitored the emission of chaff and dust to compare the commercial makes, grain types and operational conditions. The combined paddy threshers showed 1.8% damaged grain, 0.2% blown grains, 1.6% grain losses, 96.7% threshing recovery, 98.8% threshing efficiency, 90.7% cleaning efficiency, 1178 kg/h corrected output capacity and Rs. 2744 actual cost of threshing per metric ton of output at 14% moisture content. It was observed that considerable level of air pollution was associated like the average chaff and dust content of operators' inhaled air and surrounding environment were 2.04 mg/cm2/h and 35.59 mg/cm2/h, respectively. Hence some structural modifications to the machine was recommended to be introduced to minimize the above condition. Sarafadeen K. Shittu et al. (2021) evaluated the performance of traditional, portable paddy thresher and modified paddy thresher in terms of threshing efficiency, grain damage and output capacity at different concave clearance (15, 20 and 25 mm), cylinder peripheral velocity. The pedal operated paddy thresher had a capacity of 40.68kg/h. The heart rate per kg in using the pedal operated paddy thresher was recorded as 32 beats/kg. The pedal operated paddy thresher recorded an average speed of 158.3rpm in operation. The pedal operated paddy thresher recorded 29.6% losses during operation.

The paddy thresher (Mk-II) design differs from the paddy thresher (Mk-I) design in that it has larger overall dimensions, faster tool shaft speeds, larger drum sizes, more loops of aluminium wire, a winnowing fan powered by a motor, and sturdy large wheels for easy movement. To protect the grain being flown away and landing on the motor, poly sheet covers are employed.

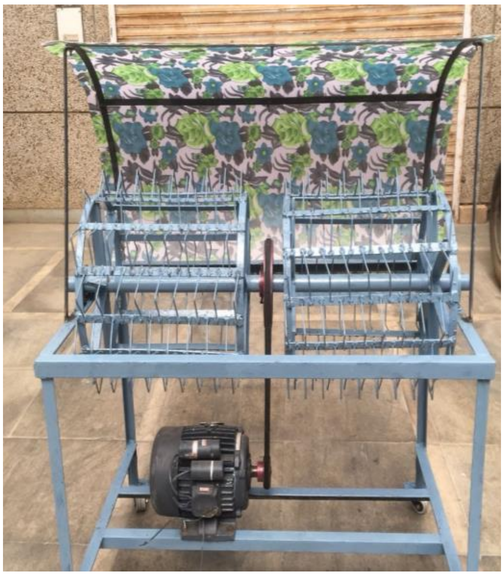

Figure 1a Paddy Thresher (Mk-I)

Figure 2b Paddy Thresher (Mk-II)

Design and development of paddy thresher (Mk-II)

The thresher includes With the necessary mild steel angle measurements, a drum composed of four folded strips that are 31.33 cm apart from one another and 13 straight strips that are 11 cm apart from one another. Thin, tiny strips are attached to the hub at the drum's round end for stability. Hub and bearings allow for the mounting of the drum on the solid shaft. The paddy is taken out of the panicle using wire loops set on drum strips. According to the theory of maximum shear stress, the mild steel shaft carrying the drum bearing the bending and twisting load was developed for its diameter. Wheels, fans, pulleys, V-belts, poly sheets, and ball bearings are mounted in accordance with the necessary specifications. The power necessary is computed for an induction motor with a safety factor of 2 for the specified maximum tool shaft speed of 578 rpm. Six strips of equal length, each 18 cm long, support a hub with a 5 cm diameter, which is welded to the centre of each end of a circular ring. Aluminum alloy wire loops are welded on two successive strips at an angle of 7 degrees from the right side of normal in a pattern where the teeth are separated from one another by 2 cm. These two strips have a total of 12 teeth. The table below contains the full specification for the prototype Paddy Thresh (Mk- I & II):

Table 1: Specifications of Paddy Thresher Mk-I & Mk-II

Specifications of Paddy Thresher (Mk-I) [10]

Particulars	**Specifications.**
Type of machine	Power operated paddy thresher cum winnower (Mk-I)
Length x width x height	1130 x 695 x 1304
Horse power (HP)	2 HP, 1.5 kw, Single phase induction motor
Revolution per minute (rpm)	1440 RPM
Number of Pulley	2
Diameter of Driving pulley	76.70 mm
Diameter of Driven pulley	203.2 mm
Diameter of bearings	80/80 (internal diameter of ball bearing is 40 mm)
Blades size	406 mm
Speed	1440 rpm

Specifications of Paddy Thresher (Mk-II)

Particulars	**Specification**
Types of machines	Power operated paddy thresher cum winnower (Mk-II)
Horse power (HP)	2 HP, 1.5 kw, single phase induction motor
Revolution per minute	1440 rpm
Required maximum tool shaft speed	578 rpm
Diameter of motor pulley (mm)	102
Diameter of shaft (mm)	254
Diameter of fan pulley (mm)	102
Diameter of transmission Shaft	40 mm, length 114 cm
Speed (R.P.M)	1440
Size of Belts	B55 and B66 included angle 30^O to 40^0
No of cylindrical drum	1
Diameter of drum (mm)	460

Experimentation and evaluation

The Paddy Thresher (Mk-II) was tested on paddy types like Sri Ram, 6444, and Brevant in accordance with the experimentation and assessment done in accordance with the Indian Standard Test Code for Power Thresher, IS: 6284-1985. Before beginning the testing, the test samples were collected after the thresher had been cleaned of dust and debris. The percentage of water by weight in paddy or rice used to describe moisture content. Wet base, or moisture content, is a term used to describe the overall weight of the grain including water. Here, it is assumed that the grain and paddy stalk moisture content is within acceptable limits. In order to avoid too many un-threshed panicles and plant residues, the threshing machine is fed continuously and regularly without introducing excessive quantities of product. The testing was conducted in sunny weather with a tolerable relative humidity level and a local temperature of 35.5 °C.

Testing of Sri Ram, 6444 and Brevant of paddy varieties

The observation of threshing of Sri Ram, 6444 and Brevant of paddy varieties on paddy thresher (Mk-II) is tabulated below in the form of independent and dependant parameters like total weight of paddy (W), weight of grain (Wg), weight of dust (Wd), weight of straw (Ws), weight of un-threshed grain (Wu), threshing efficiency (ηt), cleaning efficiency (ηc), grain ratio (GR), and percentage of un-threshed grain using following formulae.

C=W/T, where, C = Capacity of machine, kg/h;

W= Weight of paddy fed in the machine, kg; T= Time taken for threshing;

$\eta t = [Wg/ (Wg + Wu)] \times 100$

$\eta c = [Wg/ (Wg + Wd)] \times 100$

$G.R. = Wg/ W$

Percentage of un-threshed grain = $[Wu/ (Wg + Wu)] \times 100\%$

Paddy Thresher (Mk- I & II) trial on variety of paddy like Sri Ram, 6444 and Brevant. Paddy thresher (Mk- I & II) is tried on different variety of paddy like Sri Ram, 6444 and Brevant for its parametric performances like threshing efficiency, cleaning efficiency, cleaning efficiency, grain ratio, and percentage of un-threshed grain is shown at Table 2 and 3.

Table 2 Data obtained on Paddy Thresher (Mk-I)

Paddy-Variety	Avg. Speed of drum (rpm)	Total weight of Paddy, (kg)	Time (min.)	Weight of Grain, (kg)	Weight of un-threshed grain, (kg)	Weight of Dust, (kg)	Weight of Straw, (kg)	Threshing efficiency (η_t)	Cleaning efficiency (η_c)	Grain ratio	Percentage of un-threshed grain	Threshing input capacity, kg/h
Paddy – Sri Ram	539	114	5.61	33.465	4.0	0.800	80.53	89.39	93.56	0.624	10.60	1219.25
Paddy-6444	435	90	4.45	24.77	2.5	0.630	65.23	90.01	96.47	0.680	9.09	1213.48
Paddy-Brevant	444	99	5.91	33.84	3.5	0.750	65.16	90.68	97.80	0.575	9.32	1005.07

Table 3 Data obtained on Paddy Thresher (Mk-II)

Paddy-Variety	Speed of drum (rpm)	Total weight of Paddy, (kg)	Time (min.)	Weight of Grain, (kg)	Weight of un-threshed grain, (kg)	Weight of Dust, (kg)	Weight of Straw, (kg)	Threshing efficiency (η_t)	Cleaning efficiency (η_c)	Grain ratio	Percentage of un-threshed grain	Threshing input capacity, kg/h
Paddy – Sri Ram	418	76.5	4.18	26.71	1.47	0.830	49.79	94.84	95.94	0.624	5.16	1098.00
Paddy-6444	399	90	6.00	30.235	1.8	0.800	59.765	94.48	95.98	0.680	5.52	900.00
Paddy-Brevant	418	99	6.50	32.545	2.5	0.780	66.455	92.82	95.17	0.575	7.17	913.38

Table 2 and 3 revealed that the threshing efficiency of Thresher Mk-II machine proved to be superior than Mk-I machine while threshing was carried out on Sri Ram, 6444 and Brevant paddy varieties. But the cleaning efficiency was higher for Sri Ram, 6444 and Brevant varieties on Thresher Mk-I. The grain ratio varied from 0.624 to 0.575 for Sri Ram, 6444 and Brevant varieties. The threshing input capacity of Paddy threshers for Sri Ram, 6444 and Brevant varieties was reported to be 12.19 qtl/h, 12.14 qtl/h, and 10.05 qtl/h when trialled on Paddy thresher Mk-I and 10.98 qtl/h, 9.00 qtl/h, 9.13 qtl/h when trialled on Paddy thresher Mk-II respectively with the tool shaft speed (drum speed) 578 rpm.

Comparison of paddy thresher Mk –I and Mk-II

Table 6 compares the capacity, thermal efficiency, cleaning efficiency, and percentage of un-threshed grain of the power operated paddy thresher Mk-II for the paddy varieties Sri Ram, 6444, and Brevant. The table shows that while the cleaning effectiveness of the Mk-I and Mk-II paddy threshers was roughly equal, the Mk-I paddy thresher had a larger threshing input capacity. The paddy thresher Mk-II, however, had a greater threshing efficiency than the Mk-I. Due to the bigger size of the wheels installed in Mark-II for easier manoeuvrability, Mk-II is more portable than Mk-I.

Table 6 Comparison of Paddy Thresher Mk –I and Mk-II

Sl. No.	Terms	Paddy Thresher Mk-I[8]	Paddy Thresher Mk-II
1.	Threshing input capacity	1145.93 kg/h	970.33 kg/h (average)
2.	Threshing efficiency	90.03 %	94.05 % (average)
3.	Cleaning efficiency	95.94 %	95.70 % (average)
4.	Percentage of un-threshed grain	9.67 %	5.95 % (average)
5.	Portability	Portability difficult	Portability easy with wheels

Power consumption analysis

The tables 4a, 4b,4c showed the power consumption on paddy thresher (Mk-I) without load and with load for paddy varieties namely Sri Ram, 6444 and Brevant. The without load average per unit energy consumption for Sri Ram, 6444 and Brevant paddy was recorded constant as 1.449 kwh whereas at load this varied from 1.843 kwh to 1.971kwh at variant moisture content under limit.

Similarly, the tables 5a, 5b,5c showed the power consumption on paddy thresher (Mk-II) without-load and with-load for paddy varieties namely Sri Ram, 6444 and Brevant. The without-load average per unit energy consumption for Sri Ram, 6444 and Brevant paddy was recorded constant as 2.412 kwh whereas at load this varied from 3.308 kwh to 3.067 kwh at variant moisture content under limit.

Table 4a Power Consumption Analysis of Paddy Thresher Mk-I : Paddy – Sri Ram

Trials	Without Load,				With Load, Moisture 20.02%						
	RPM of machine/ motor	Voltage	Current in amp	Unit consumption per hour	Total Wt. of Paddy, (kg)	Time (min)	Wt. of Grain, (kg)	RPM of machine/ motor	Voltage	Current in amp	Energy consumption in unit per hour (kwh)
T-1	540/1440	170	4.9	0.833	38	1.68	11.13	531/1439	170	6.2	1.054
T-2	543/1444	220	6.4	1.408	40	1.96	11.72	541/1443	220	7.1	1.562
T-3	549/1455	245	10.7	2.107	36	1.76	10.54	547/1451	245	11.9	2.915
Average unit consumption				**1.449**	**Average unit consumption**						**1.843**

Table 4b Power Consumption Analysis of Paddy Thresher Mk-I : Paddy – 6444

Trials	Without Load,				With Load, Moisture 14.82%						
	RPM of machine/ motor	Voltage	Current in amp	Unit consumption	Total Wt. of Paddy, (kg)	Time (min)	Wt. of Grain, (kg)	RPM of machine/ motor	Voltage	Current in amp	Energy consumption in unit per hour (kwh)
T-1	540/1440	170	4.9	0.833	30	1.47	8.10	400/1440	170	6.1	1.037
T-2	543/1444	220	6.4	1.408	35	1.71	9.63	430/1442	220	7.8	1.716
T-3	547/1455	245	10.7	2.107	25	1.22	6.75	475/1452	245	12.4	3.038
Average unit consumption				**1.449**	**Average unit consumption**						**1.930**

Table 4c Power Consumption Analysis of Paddy Thresher Mk-I : Paddy – Brevant

Trials	Without Load,				With Load, Moisture 12.95%						
	RPM of machine/ motor	Voltage	Current in amp	Unit consum-ption	Total Wt. of Paddy, (kg)	Time (min)	Wt. of Grain, (kg)	RPM of machine/motor	Voltage	Current in amp	Energy consumption in unit per hour (kwh)
T-1	540/1440	170	4.9	0.833	45	2.65	15.34	413/1439	170	6.6	1.112
T-2	543/1444	220	6.4	1.408	30	1.77	10.23	435/1442	220	7.8	1.716
T-3	547/1455	245	10.7	2.107	20	1.18	6.82	486/1453	245	12.6	3.087
Average unit consumption				**1.449**	**Average unit consumption**						**1.971**

Table 5a Power Consumption Analysis of Paddy Thresher Mk-II : Paddy – Sri Ram

Trials	Without Load,				With Load, Moisture 20.02%						
	RPM of machine/ motor	Voltage	Current in amp	Unit consumption per hour	Total Wt. of Paddy, (kg)	Time (min)	Wt. of Grain, (kg)	RPM of machine/ motor	Voltage	Current (amp)	Energy consumption in unit per hour (kwh)
T-1	422/1440	170	9.3	1.581	36.5	1.97	12.73	410/1438	170	13.2	2.244
T-2	431/1444	220	11.9	2.618	20	1.08	6.98	420/1441	220	16.1	3.542
T-3	439/1456	245	12.4	3.038	20	1.08	6.98	426/1444	245	16.9	4.140
Average unit consumption				**2.412**	**Average unit consumption**						**3.308**

Table 5b Power Consumption Analysis of Paddy Thresher Mk-II : Paddy – 6444

Trials	Without Load,				With Load, Moisture 14.82%						
	RPM of machine/ motor	Voltage	Current in amp	Unit consumption per hour	Total Wt. of Paddy, (kg)	Time (min)	Wt. of Grain, (kg)	RPM of machine/ motor	Voltage	Current in amp	Energy consumption in unit per hour (kwh)
T-1	422/1440	170	9.3	1.581	35	2.31	11.75	392/1439	170	13.8	2.346
T-2	431/1444	220	11.9	2.618	30	1.98	10.07	395/1442	220	15.6	3.432
T-3	439/1456	245	12.4	3.038	25	1.65	8.39	411/1450	245	16.3	3.993
Average unit consumption				**2.412**	**Average unit consumption**						**3.257**

Table 5c Power Consumption Analysis of Paddy Thresher Mk-II : Paddy – Brevant

Trials	Without Load,				With Load, Moisture 12.95%						
	RPM of machine/ motor	Voltage	Current in amp	Unit consumption per hour	Total Wt. of Paddy, (kg)	Time (min)	Wt. of Grain, (kg)	RPM of machine/ motor	Voltage	Current in amp	Energy consumption in unit per hour (kwh)
T-1	422/1440	170	9.3	1.581	45	2.92	14.76	414/1440	170	12.3	2.091
T-2	431/1444	220	11.9	2.618	30	1.95	9.84	417/1443	220	14.9	3.238
T-3	439/1456	245	12.4	3.038	24	1.56	7.87	423/1449	245	15.8	3.871
Average unit consumption				**2.412**	**Average unit consumption**						**3.067**

Economic analysis

Table 6a and 6b showed the economic analysis of threshing on paddy thresher Mk- I & II per quintal of paddy when wages @ Rs. 400/- for 8 hours a day was taken, it was found that the average total cost of operation on thresher Mk-I was found to be Rs. 28.00 per quintal per hour whereas for Mk-II it was Rs. 38.00 per quintal per hour.

Table 6a Economic Analysis

Threshers	Paddy Variety	Average unit consumption		No. of Labor required	Wages per day of 8 h	Total Amount (Rs)	Threshing input capacity kg/h	Output capacity (Kg/h)	Cost of operation (Rs/qtl) per hour
		With out Load	With Load						
Paddy Thresher Mk-I	Sri Ram	**1.449**	**1.843**	3	400	1200	1212.76	409.28	12.36
	6444	**1.449**	**1.930**	**3**	400	1200	1216.22	376.18	12.33
	Brevant	**1.449**	**1.971**	**3**	400	1200	1005.00	386.70	14.92
Avg. Cost of operation (Rs/qtl)									**13.20**
Paddy Thresher Mk-II	Sri Ram	**2.412**	**3.308**	3	400	1200	1098.00	417.56	13.66
	6444	**2.412**	**3.257**	**3**	400	1200	900.00	328.30	16.66
	Brevant	**2.412**	**3.067**	**3**	400	1200	913.38	355.56	16.42
Avg. Cost of operation (Rs/qtl)									**15.58**

Table 6b Economic Analysis

Threshers	Variety	Cost of Energy consumption in unit per hour (kwh) @ Rs. 8.00 (A)	Cost of operation (Rs/qtl) per hour (B)	Total cost of operation Rs per quintal per hour (A+B)	Avg. operation cost of Thresher (Mk-I & II) per quintal per hour
Paddy Thresher Mk-I	SriRam	1.843x8=14.74	12.36	Rs. 27.10	**Rs 28.52 (Avg.)**
	6444	1.930x8=15.44	12.33	Rs. 27.77	
	Brevant	1.971x8=15.77	14.92	Rs. 30.69	
Paddy Thresher Mk-II	SriRam	3.308x8=24.64	13.66	Rs. 38.30	**Rs. 37.99 (Avg.)**
	6444	3.257x8=26.06	16.66	Rs. 42.72	
	Brevant	3.067x8=16.54	16.42	Rs. 32.96	

Conclusions

The performance evaluation and economic analysis of Paddy Thresher (Mk-I & II) was carried successfully carried out following Indian Standard Test Code for power thresher IS: 6284-1985. The parameters obtained for threshing different varieties of paddy are quite closer to the standard paddy threshing. Both machines' performance parameters were compared and was examined economically by keeping electrical tariff and current wages into considerations. It was concluded that the paddy thresher Mk-I had viz. the threshing efficiency, cleaning efficiency, percentage of un-threshed grain and threshing input capacity 90.03 %, 95.94 %, 9.67 %, 1145.93 kg/h respectively. While the paddy thresher Mk-II had viz. threshing efficiency, cleaning efficiency, percentage of un-threshed grain and threshing input capacity 94.05%, 95.70 %, 5.95 % and 970.33 kg/h respectively.

The average cost of operation on paddy thresher (Mk-I) was accounted for Rs. 13.20 per quintal and for Mk-II it was Rs. 15.58 per quintal. Further, the average total cost of operation on thresher Mk-I was found to be Rs. 28.00 per quintal per hour whereas for Mk-II it was Rs. 38.00 per quintal per hour.

Ultimately it was concluded that paddy thresher Mk-I was economical to be used though the threshing efficiency of paddy thresher Mk-II was found to be higher.

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