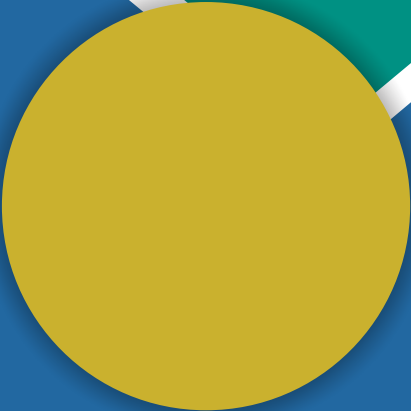


Beater Wheat Thresher



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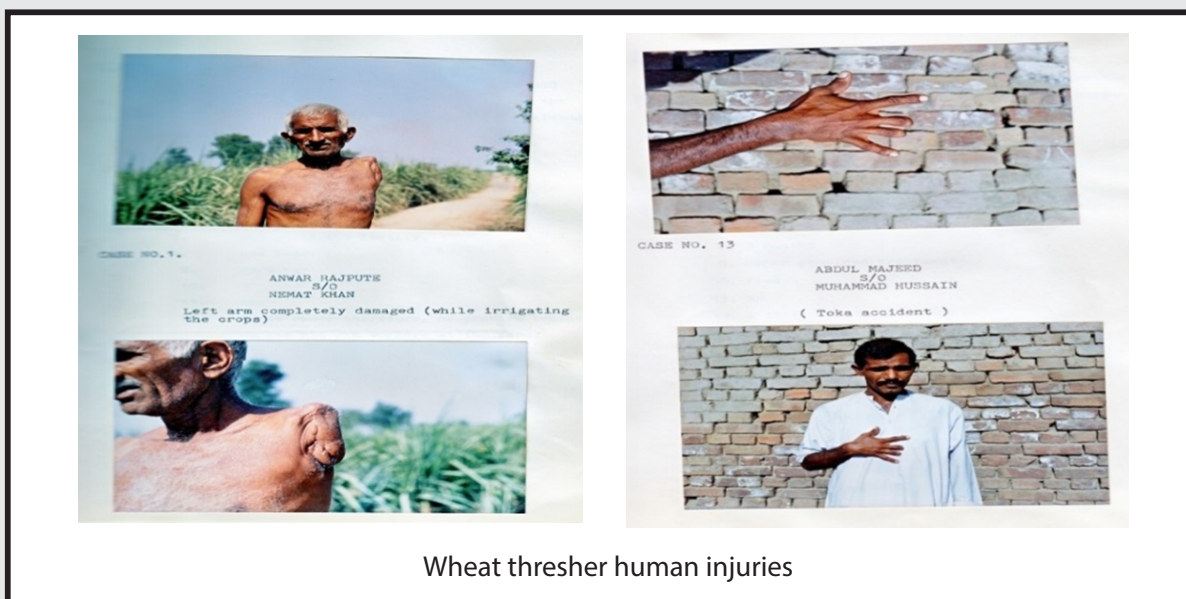
In Pakistan, there are about 500 large companies manufacturing agricultural machinery and implements, with a capacity of 1.38 million per annum such as wheat threshers, sugar cane crushers, chaff cutters, sprayers, rice hullers, rice husking machines, rice polishing machines, ploughs, drills, cultivators, plant protection equipment. The development of mechanical threshers for the purpose has clearly an edge over conventional methods and has reduced the drudgery of work to a great extent. It has been documented that the total loss of wheat from bullock threshing, semi-mechanical threshing; threshing with thresher and combine harvester amounted to 3.11, 2.68, 2.01, and 1.2%, respectively. The combine harvester had the minimum and the thresher had the 2nd last minimum grain losses indicating the importance of thresher use as compared with the bullock threshing.

At present, about 139777 wheat threshers are being used in Punjab alone. Considering an average use of nearly 150 hours per year with consumption of diesel oil as 7.50 L/h/tractor @ Rs.87/L, the total cost of fuel consumed annually on wheat threshing in the Punjab is estimated at 13.7 billion (PAK) rupees. This is a substantial amount of money for an oil importing country like Pakistan. Mechanical wheat threshing has gained a spectacular popularity in Pakistan over a short span of time and so is the population of beater-wheat threshers that are being manufactured and marketed by the roadside vendors with little scientific and engineering experience. They are just copying the threshers of others without having the knowledge of standard and quality and thus produce machines of different specifications and of different weights which need more power to operate than is actually required. Moreover, the safety criterion for the operators had completely been ignored. It has been reported that 16% of human injuries have been associated with unsafe operation of threshers. The major problems on conventional threshers are bulky weight, poor machine performance, 16% of human injuries and a high fuel consumption rate. A review of the conventional thresher suggests presence of three heavy flywheels with little scientific argument and similarly poorly designed threshing beaters and five MS rings on the beater-drum appear injudicious and unscientific. A horizontal throw of straw from the exhaust-blower takes away a noticeable amount of grains with it. Conventional threshers have witnessed terrifying accidents for the persons feeding the material without any safe crop feeding system. The local manufacturers least care about the fabrication drawings of the conventional machines and therefore their knowledge of manufacturing is restricted to the whims and wishes of "*ustad-shagird*" (seniors juniors).

Machine development

A conventional beater wheat thresher of Noorani Industries, Samundari Road, Faisalabad was procured and dismantled. Reverse engineering approach was employed to modify designs and developing drawings of various components of thresher such as flywheel, beater, beater drum, blower and feeding conveyer using Solid Works software. Moreover, a feed conveyor was designed and installed to uniform the crop feed rate in-order to avoid threshing fluctuations. After assembling the thresher components, it was extensively tested at farmers fields for two successive years

Total weight of redesigned beater wheat thresher was reduced from 1600 kg to 1300 kg and the grain damage was reduced four times. The mean threshing efficiency was increased from 98% to 99%. The replacement of the three flywheels by one redesigned flywheel of required size saved 24.37kN-m energy. The fluctuation in speed was reduced to 3.05 times and coefficient of energy 3.11 times than that of conventional thresher. By redesigning and redeveloping the direction of fan blower exhaust, the mean grain cleaning efficiency improved from 97.44 to 98.18 % causing elimination of grain loss through straw blowing process. A newly designed feed conveyor uniformed the crop feeding rate that not only eliminated overloading of thresher but also reduced the fuel consumption by 1.3 L/hr (15 kW).



Wheat thresher human injuries



Wheat threshing with redeveloped thresher

Economic return of threshers

Item	Conventional Thresher	Redeveloped Thresher
Total Wight, kg	1600	1300
Unit Price, Rs. (@ Rs. 150/kg)	240,000	195000
Material Capacity, kg/hr	1000	1000
Tractor	Tractor = MF-375 (75 HP)	Tractor = MF-375 (75 HP)
Fuel Consumption, L/hr	7.5	6.2
Operational cost, Rs./hr	1506	1278.41
Hiring cost, Rs./hr (@ 4kg/40kg)	2375	2375
Economic Return, Rs. /	869	1096 (26% more return)