

Combine Harvesters

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Abstract

Agriculture is the oldest and largest industry of the world which provides the materials to meet the basic needs of mankind – food, clothing and shelter. Countries with highly developed agriculture and industry are advanced states of the world. The combine harvester or simply the combine is a machine that combines the harvesting, threshing and cleaning of grain crops such as maize, soya bean, flax, oats, wheat or rice. The waste straw left behind on the field is the remaining dried stems and leaves of the crop with limited nutrients which is either chopped and spread on the field or baled for feed and bedding for livestock. Combine harvesters are one of the most economically important labour saving inventions, significantly reducing the fraction of the population that must be engaged in agriculture.

Keywords: Harvesters, Tractor-drawn combines, Agriculture.

Introduction to Combine Harvester

Scottish inventor Patrick Bell invented the reaper in 1826. The first combine was invented by Hiran Moore in 1834 in the USA and it took many decades for the combine to be popular. Early versions were pulled by horse, mule or ox teams. Moore built a full-scale version in 1835 and by 1839 it could successfully harvest over 20 ha of crops. The combine harvesters with a cutting width of several metres were used on American farms by 1860. The Sunshine Harvester, a commercially successful combine harvester, was produced by Australian Hugh Victor McKay in 1885. Early combines even used 16 horses to pull them whereas later combines used steam engines. Tractor drawn and PTO powered combines were also used for some time followed by self-propelled combines using diesel engines.

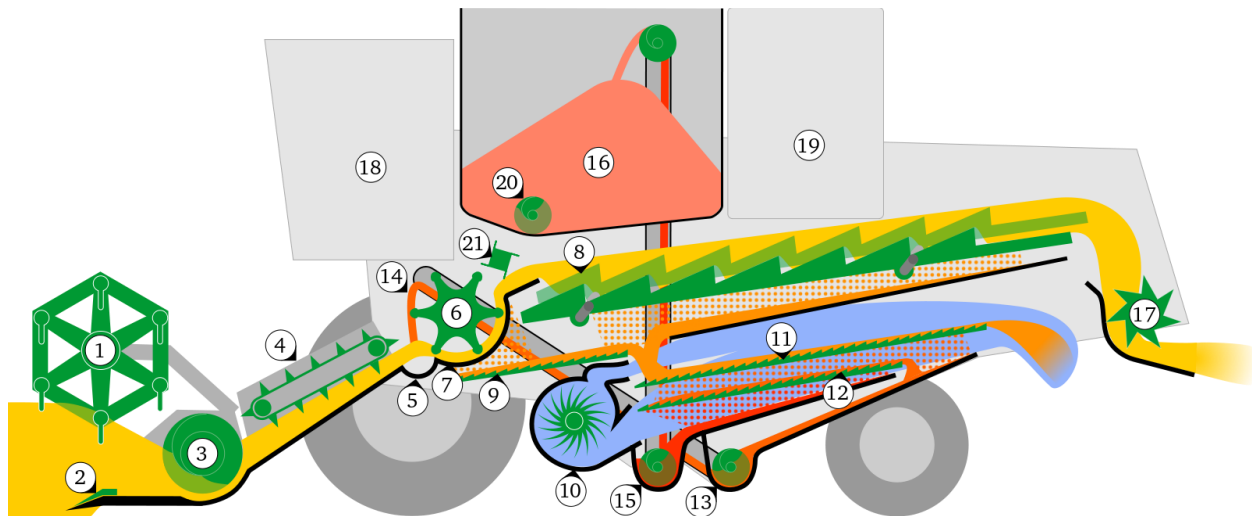
The Holt Manufacturing Company of California produced a self-propelled harvester in 1911. M/s International Harvesters started making horse-pulled combines in 1915. At the time horse

powered binders and stand-alone threshing machines were more common. In the 1920s Case Corporation and John Deere made combines and these were starting to be tractor pulled with a second engine aboard the combine to power its workings. The patented Sunshine Auto Header was one of the first center-feeding self-propelled harvester in 1923 in Australia. The Baldwin brothers and their Gleaner Manufacturing Company patented a self-propelled harvester in Kansas in 1923 that included several other modern improvements in grain handling. Both the Gleaner and the Sunshine used Fordson engines; early Gleaners used the entire Fordson chassis and driveline as a platform. Alfredo Rotania of Argentina patented a self-propelled harvester in 1929. The world economic collapse in the 1930s stopped farm equipment purchases thus people largely retained the older method of harvesting. A few farms did invest and used Caterpillar Tractors to move the outfits.

Tractor-drawn combines (also called pull-type combines) became common after World War II as many farms began to use tractors. An example was the All-Crop Harvester Series. These combines used a shaker to separate the grain from the chaff and straw-walkers (grates with small teeth on an eccentric shaft) to eject the straw while retaining the grain. Early tractor-drawn combines were usually powered by a separate gasoline engine, while later models were PTO-powered. These machines either put the harvested crop into bags that were then loaded onto a wagon or truck, or had a small bin that stored the grain until it was transferred to a truck or wagon with an auger. In the U.S., Allis-Chalmers, Massey-Harris, International Harvesters, Gleaner Manufacturing Company, John Deere and Minneapolis Moline are known as past or present major combine producers. A self-propelled model was perfected in 1937 by Australian-born Thomas Carroll, working for Massey-Harris in Canada and in 1940 a lighter-

weight model began to be marketed widely by the company. Lyle Yost invented an auger that would lift grain out of a combine in 1947, making unloading grain much easier. In 1952 Claey's launched the first self-propelled combine harvester in Europe in 1953, the European manufacturer Claas developed a self-propelled combine harvester named "Hercules" which could harvest up to 5 tons of wheat a

day. This newer kind of combine is still in use and is powered by diesel or gasoline engines. Until the self-cleaning rotary screen was invented in the mid-1960s combine engines suffered from overheating as the chaff spewed out when harvesting small grains would clog radiators, blocking the airflow needed for cooling.



(By Hans Wastlhuber & Tucvbif)

Figure 1: Conventional combine harvester

- 1) Reel 2) Cutter bar 3) Header auger 4) Grain conveyor 5) Stone trap 6) Threshing drum 7) Concave 8) Straw walker 9) Grain pan 10) Fan 11) Top Adjustable sieve 12) Bottom sieve 13) Tailings conveyor 14) Rethreshing of tailings 15) Grain auger 16) Grain tank 17) Straw chopper 18) Driver's cab 19) Engine 20) Unloading auger 21) Impeller.

Indian Scenario

The combine harvesters are in use in India since 1971.

Odisha, one of the most progressing and promising states of India in general and of the Eastern part of the country in particular has owned laurels by continuously winning Krishi Karman Award for three times followed by International Award for agriculture development.

A significant advance in the design of combines was the rotary design. The straw and grains were separated by a powerful fan. Axial-Flow combine harvesters were introduced by International Harvester Company during 1997. During 1980s; on-board electronic gadgets were used to measure the threshing efficiency. This new instrumentation allowed the operators to get better grain yields by optimizing ground speed and other operating parameters.

The present need is to equally develop the industries, particularly the agro based industries to make it one of the highly developed states of our country. The farm implement and machinery industry in Odisha was limited to manufacturing and selling items worth of Rs.40 lakh in 1985 as compared to Rs.1000 lakh at present. The number of combine harvesters being used by our farmers' now stands at 3000 starting with the first one in 2002. The first self-propelled combine harvester "CLAAS" was procured by OUAT under

NATP Programme by the College of Agricultural Engineering & Technology during 2002.

These combine harvesters used in the Odisha and other states are being manufactured mostly in Punjab and Haryana. The development of combine manufacturing industry grew up in Punjab with the 200 units being imported from abroad in 1972 to Punjab to overcome the labour shortage during harvesting of wheat crop. There is enough opportunity to promote combine harvester

manufacturing along with power tillers, self-propelled rice transplanters, power paddy reapers and other items to make Odisha agriculture developed, commercial and profitable.

The make and models of combines being marketed in the state with the approval of State Level Technical Committee (SLTC) is given in Table 1 and the year wise sale of combine harvesters along with other machinery is shown in Table 2.

Table 1: SLTC Approved Combine Harvesters for Sale in Odisha (2018-19)

Sl.No.	Firms	Approved Make/model/specifications
1	2	3
COMBINE HARVESTER (SELF PROPELLED) (TRACK TYPE)		
1	Dasmesh Mechanical Works Pvt. Ltd., 1 Rajkot Road, Marerkotla - 148023, Dist-Sangrur, (Punjab), India	Combine Harvester Self-Propelled (TRACKTYPE) Make- Dasmesh, Model- DASMESH-726-SW (Variant), Power- 50.6 PTO hp
2	Mahindra and Mahindra Ltd. FES SWARAJ Plot No. 388, V.N. Marg, Goutam Nagar, Bhubaneswar	Combine Harvester Make- Mahindra & Mahindra Ltd. Model- PRO COMBINE 7060 Track type, self propelled, Power - 54.3 Kw
3	Nani and Kishore Agros Private Limited, Door No. 8-24-64 (New No.12/82NNR/24/1), Gaddipadu, Autonagar, Besides Reliance Petrol Pump, Guntur-522001, Andhra Pradesh	Combine Harvester Make-Taizhou Changfa Agricultural Equipment Co. Ltd., Model- CF 805 SD Type- Self Propelled (Track Type) Power- 88.10 PTO HP, Diesel engine
COMBINE HARVESTER (SELF PROPELLED) (Tractor Mounted)		
1	Dasmesh Mechanical Works Pvt. Ltd. Rajkot Road, Marerkotla - 148023, Dist-Sangrur, (Punjab), India	Combine Harvester Tractor operated Make & Model- DASMESH – 912 Power - 37.4 PTO hp
The pattern of assistance would be as per the State Agricultural Policy 2013		
The approved make & model mentioned above are for the purpose of subsidy sale only.		

Table 1: Year wise Sale of Implements in Odisha

Year	Pumpset	Paddy reaper	Tractor drawn rotavator	Self propelled transplanter	Power thresher	Axial flow thresher	Combine harvester	SCFD/special power driven implements
1999-00	13523	-	-	-	-	-	-	
2000-01	35071	270	-	-	-	-	-	
2001-02	49660	165	-	-	-	-	-	
2002-03	63105	90	10	-	-	15	-	
2003-04	76305	70	24	-	101	30	-	
2004-05	88871	85	41	10	169	75	-	
2005-06	102702	94	50	11	197	83	-	
2006-07	118988	94	48	8	205	123	-	
2007-08	139143	110	67	13	253	227	4	
2008-09	169190	290	47	47	831	405	49	
2009-10	223843	479	46	30	1412	502	72	
2010-11	292550	869	311	42	2437	805	123	
2011-12	300000	696	250	45	2380	535	78	
2012-13	31000	1069	469	166	-	1028	178	40
2013-14	34000	614	4700	619	-	2472	420	176
2014-15	29992	360	4531	521	5270	3354	264	3419
2015-16	28948	696	5351	803	2500	3729	516	1154
2016-17	29543	456	5550	654	2550	3450	451	-
2017-18	28789	543	5237	534	2497	3523	459	-
2018-19	29458	437	5452	557	2564	3612	467	-
Total	18,55,183	7487	32184	4060	23366	23968	3081	4789

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