Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

A National Conference On Spectrum Of Opportunities In Science & Engineering Technology
Volume 5, Special Issue 06, April-2018 (UGC Approved)

AGRICULTURE BASED REAPER

Prof. Swapnil Umale[1], Vishal Thakare[2], Atul Takle[3], Shubham Malokar[4], Kanchan Bhaltilak[5]

[1]*Asst. Professor, Department of Mechanical Engineering, Siddhivinayak Technical Campus, Shegaon, Maharashtra, India.*
[2,3,4,5] *Students, Department of Mechanical Engineering, Siddhivinayak Technical Campus, Shegaon, Maharashtra, India.*

Abstract: *The crop cutting is the important stage in the field of agriculture. In our India currently the farmers are using conventional method for crop cutting i.e. manually using labor and this method is very lengthy as well as time consuming so to avoid such a problems of crop cutting the reaper may be used, also the reaper may be used for the purpose of a grass cutting.*

It is the form of a crop cutter which is very essential for the agriculture , in this project we are also focusing on the harvesting operations to the land holders for harvesting the variety of crops in less time and at the minimum cost, also in this project we are focusing on the problems caused by the reaper. The equipment is directly attached to the back side or to a front side of a tractor and it works on the power transmitting object (PTO) which is given to the tractor.

Keyword: *Agriculture reaper, crop cutter.*

I. INTRODUCTION

One of the major challenges for the agriculturist is to ensure adequate food to feed the growing population. Paddy, wheat and other cereal crops play a vital role in national food security. The total food-grain production was 254.67 MT in crop year 2015-16 as compared to the highest ever food-grain production of 257.07 MT in year 2014-15. In which, the contribution of rice was 103.04 MT in year 2015-16 and 104.65 MT in year 2014-15. Also, India is second largest producer of wheat in the world with 95.76 MT in year 2014-15 and 88 MT in year 2015-16. Total food grain production in Gujarat was 6.192 MT, out of which rice contributed 1.76 MT during the year 2015-16. To ensure timeliness of farming operations and increase the income from a piece of land, farm mechanization of agricultural operation is essential, so that job may be done effectively and efficiently to improve productivity. It does not mean the use of only big machines and tractors for farm work, but, it also involves use of small improved equipment to enhance the efficiency as well as quality of work. [1] .

Farmers with small holdings may utilize many improved farm equipment to increase their returns from the farm. Various improved small and large equipment for different agricultural operations viz. tillage, sowing, irrigation, plant protection and threshing have been widely available, accepted by and being used by the farmers. Harvesting of crops is one of the most labour intensive operations, which is to be carried out at an appropriate stage of crop maturity to minimize the field losses, thereby, to increase the crop yield. Field crop harvesting operation includes holding, cutting and windrowing of crop. It is important to apply good harvesting methods to maximize grain yield, and minimize grain damage and quality deterioration. Generally, traditional method of harvesting crop manually is by using sickles and knives. It is highly time consuming and labour intensive drudgery some act. Harvesting of field crop takes about 185-340 man-h/ha to cut and bundle paddy or wheat crops (Michael and Ojha, 1987). Harvesting operation alone needs 20% and 16% of total labour requirement for kharif and Rabi rice, respectively (Sarkar, 2000) [2]. To minimize the time and labour involved, various power tiller operated/tractor operated/self-propelled harvesters/reapers and combine harvesters are available.

A. Importance of project

This project is to help small-scale farmers to meet an increased demand for local grains, by designing a reaper machine to harvest grains more efficiently. Our research work will focusing on ease of harvesting operation to the small land holders for harvesting varieties of crop in less time, cost of equipment , ease of operation , field condition , time of operation and climatologically conditions..

B. Reaper selection

Reaper is generally selected on the land holding of the farmer, greater the land holding, tractor operated vertical conveyer reaper is choose, for medium land holding power tiller mounted vertical conveyer reapers are preferred. there are some different parameters which decide the selection and performance of reaper, they are as follows;

- Should have the proper cutting speed of cutter bar.
- Should require proper crop spacing.
- Should require proper power.
- Continuous power transmission.
- Proper registration and alignment of cutter bar.

II. LITERATURE REVIEW

This chapter deals with research work done in past by various investigation on the performance of reaper this chapter deals with research work carried by various investigators on the related topics under study. The first step in the harvesting of cereal crop is called reaping. The second is called threshing. The two steps when combined together are known as combine harvesting. The harvesting equipment for various crops have been designed and developed by several researchers but very little emphasis has been placed on electric powered harvesting equipment in India. Some of them are given by categorizing in traditional methods and improved methods.

payman (2007) stated that, the height of crop stubbles increasing as stalks moisture content increased and decreased with increasing of knife velocity. He added that the percentage of wheat and rice grain losses increasing as the machine forward speed increased. Increasing cutter bar speed leads to decrease the percentage of grain losses. Also, increasing forward speed leads to increase the number of uncut stalks. [3]

Amjad in (1983) the use of a large scale machine is inappropriate for the following reason it needs high technical experience for operation and maintenance, high capital requirements. Low field efficiency is in small holding and losses of straw are high on irregular furrowed soils. The use of small machines is appropriate for small holdings, low capital requirements and low technical operations and maintenance experience [4].

III. Frame of The Reaper

A mild steel rectangular frame of length 125cm width 28 cm and height of 802 cm is constructed so that the all parts of the reaper are mounted on it are as follow

- Gear box
- Different types shafts
- Gears
- Bearings
- Blade
- Crop Supporting unit
- And crop divider are mounted on a frame

The frame is constructed in such a way that when all the parts are mounted on the frame at that time it will sustain all the loads which are impacting on it that is may be shear stress, tangential load, impact load weight of blades as well as weight of a supporting unit as well as the weight of crop divides.

Figure 1: Primary Frame

Figure 2: Complete Frame

Table No. 1: Specification of frame

1	Number of angles	2
2	Number of bearing 6204ZZ FFX P207	 6 2
3	Length	122 CM
4	Width	28 CM
5	Height	80 CM

The frame is made up of a angles which is of 2inch and 2 angles of 20 ft each is required for the construction of an main frame the frame is constructed in such a way that the frame is divided two parts the primary part is for the supporting of a shaft, gears, and mounting of a blade similarly for the mounting of a supporting frame as well as crop divider

Similarly the second portion of frame is also called secondary frame which is plays an important role in the supporting of a whole assembly on the second frame there are arms are provided for lifting the of reaper for the use

IV. Components

Shaft : A shaft is a rotating element which is used to transmit power from one place to another. The power is delivered to shaft by some tangential force and resultant torque or twisting movement set up within the shaft transmit the power to be transferred to another objects linked up to shaft. In order to transfer the power from one shaft to the various members such as pulley gears, chains, sprockets, and reciprocating objects which are mounted over it.

Bearings: Bearing can describe a range of bearing that are used in moving parts . Bearing can produce less friction than plain bearing. The bearings are roller bearing, ball bearing, plastic based bearing and specially alloy that is metallic. They are designed to reduced friction in moving parts

If the shaft revolves in beating normally, it has a sliding motion. But if balls or roller are used between the shaft and journal are used. Generally the ball or roller bearings are made up of a hardened material such as chromium steel or chrome nickel steel.

Gear: Gears are the toothed wheel or multilobed cams which are used to transmit power and motion from one shaft to another shaft when the distance between the two shafts is small. It is called as positive drive and velocity ratio remains constant. The gears are transmit larger power and are compact in construction. Also they are able to transmit the motion at very low speed.

Bevel gear: The bevel gears are used for sending power at a constant speed quantitative relation between two shafts whose axes run across at a particular angle. The pitch surfaces for the pinion and crown wheel square measure frustums of cones. the weather of the cones run across at the purpose of intersection of the axis of rotation. Since the radii of each the gears square measure proportional to their distances from the apex, so the cones might roll along while not slippery. The weather of each cones don't run across at the purpose of shaft intersection. Consequently, there could also be pure rolling at just one purpose of contact and there should be tangential slippery in the slightest degree different points of contact. Therefore, these cones can't be used as pitch surfaces as a result of it's not possible to possess positive driving and slippery within the same direction at identical time. We, thus, conclude that the weather of bevel gear pitch cones and shaft axes should run across at identical purpose.

Figure 3 : Bevel Gear

Gear box: A gear is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape.[1] Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, called a rack, producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a crossed, belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage. When two gears mesh, if one gear is bigger than the other, a mechanical advantage is produced, with the rotational speeds, and the torques, of the two gears differing in proportion to their diameters.

Figure 4: Gear Box

Blade: The available speed of cutter bar is 8 reciprocating movement with one complete rotation of rear wheel. It works successfully but there was clogging due to less number of blades in pre design of reaper. Now, the clogging is not occurring as of a new blade is reciprocating at clogging area where, one guard is already available. Before adding one blade the extra guard is not included in working. The replacement of damaged cutting blades are also done for proper functioning of cutting of crops without any trouble in movement of cutting bar and it helps to reduce clogging and cutting losses

The blades are made up of a thin metal sheet of 16 gauge with the trapezoidal section at the top and flat section at the ends the top trapezoidal section is of 2 - 2.5 inch and the flat section is of 3-48 inch the material of a blasé is M S and it is inclined at the cutting section the cutting section is made so that when the two blades overlap on each other at that time the crop can be get cut very accurately and the movement of a blades can be done with the help of a power which is coming from the shaft the blades are connected to the shaft with the help of single slider crank mechanism the blades can move vertically on the another blades of same dimensions the distance between two blades is about 3-5 mm from each other there may be friction may developed between two blades the friction is good for the cutting the crops.

The primary blade which is fixed on the angle of 2inch which do not move it is only to give the supporting or mounting of a secondary blade which is rotating about to its given path the secondary blade can move to cut the crops which mounted from back side over the wheels which are rotating left and right to their fixed path

Figure 5 : Cutting Blades

Chain and sprocket : Chain sprockets were used to transfer power from gear box to the eccentric wheel. To vary the speed of the cutter bar, 28 and 33 teeth sprockets were used in different combinations at gear box output shaft and eccentric wheel shaft.

To avoid the slipping, steel chains are used. The chain is made up of number of rigid links which are hinged together by pin joints in order to provide necessary flexibility for wrapping rounds the driving and driven wheels. These wheels have projecting teeth of special profile and fit into the corresponding process in the links of chain. The toothed wheels are known as sprocket wheels or simply sprocketb the sprocket and chain are thus constrained to move together without slipping and ensures perfect velocity ratio.

Figure 6: Chain and Sprocket

Crop cutting unit : The purpose of crop cutting unit is to cut the standing crop. For this, it consists mainly receiving blade and cutting blade as shown in Plate 3.1 and 3.2. Cutting blades reciprocate above the receiving blades, which provide support to cut the crop. The length of the cutter bar was selected on the basis of row to row spacing of crops. In general row to row spacing in paddy and wheat ranges between 200 to 300 mm, therefore, a cutter bar length of 350 mm was selected. The knife section selected was having standard stroke length of 76.2 mm. These knives were riveted on the ms flat of size 20 mm with

thickness 6 mm. to make the 350 mm cutter bar. The receiving blades were also welded on the ms flat of size 50 mm with thickness 5 mm

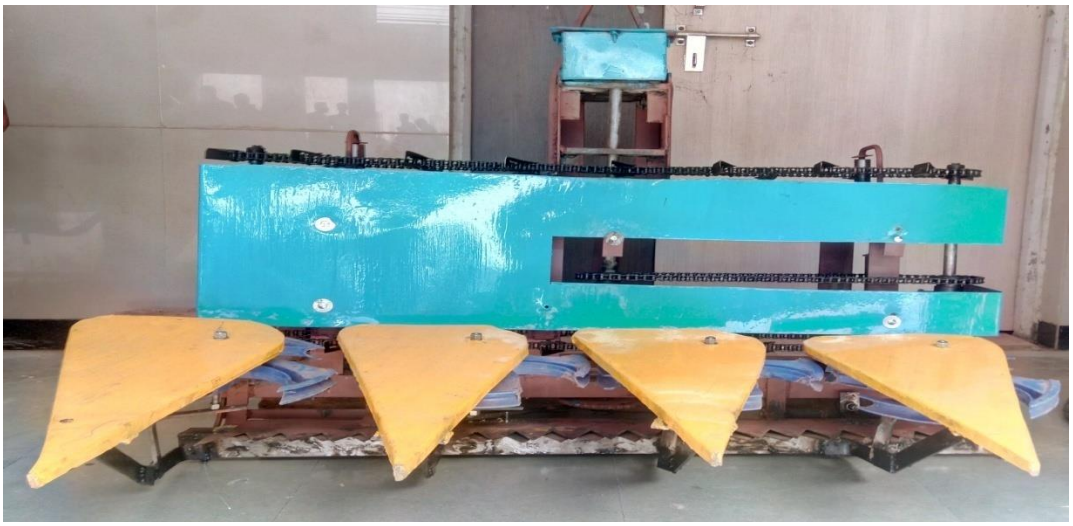

Figure 7: Fabricated Crop Cutting Unit

V. Advantages & Limitations

Advantages:

- Time required for reaping of crops is less
- Cost of labour will be decreased
- Give maximum amount of output

Limitations :

- It is not suitable for non-uniform land.
- The power requirement is high due to its weight.

VI. Conclusion

- The working of self propelled vertical conveyor reaper was found to be satisfactory. The labour requirement was found to be 11 man days per hectare including manual collection and bundling of the harvested crop compared to 22 man days of labour per hectare in manual harvesting, collecting and bundling of the crop. Thus, it saved 11 man days of labour per hectare.
- From the study, it can be concluded that the self propelled vertical conveyor powder reaper could be used successfully with a labour saving of 11 man days per hectare and reducing the drudgery of labours. The area of 2.32 ha can be harvested per day if the field capacity is kept as 0.29 ha/hr. considering the two months harvesting season, the maximum area that can be harvested using the self propelled vertical conveyor reaper will be 139.2 ha. If the machine is used for the maximum usage of 139.2 ha in a year, the cost of mechanical harvesting will be Rs. 690/- per ha as compared to Rs. 2500/- per ha in case of manual harvesting. Thus it is feasible to minimize the cost of operation of paddy harvesting. Thus mechanization in paddy harvesting is a feasible solution for reducing the cost of harvesting of paddy crop.

References

[1] Duraisamy, V.M., Senthilkumar, "Studies on standardization of spacing and transplanting depth for a self-propelled rice transplanter. Agril." Mechanization in Asia, Africa and Latin America 42 (1) : 42-44 (2011).
[2] Manjunatha, M.V. B.G., Shashidhar, S.D.and Joshi, V.R. "Field performance evaluation of vertical conveyor paddy reaper". Karnataka J. Agic. Sci., 22(1):140-142, (2009).
[3] Mohammad Reza Alizadeh, and Mr Hussein Payman "Evaluation of a rice reaper used for rapeseed harvesting." American-Eurasan J. Agric. & Environ. Sci., 2(4):388-394 , (2007).
[4] Nadeem Amjad (1983). "Field performance evaluation of rice reaper." Agril. Mechanization in Asia, Africa & Latin America. 14 : 35-40.
[5] Singh, Sukhbir, Vatsa, D.K. and Verma, M.K. (2007).Feasibility and performance evaluation of power tiller operated reaper in hills of Himachal Pradesh. Agril. Engg. Today, 31(2):6-10.
[6] Iraj bagher Evaluation of a rice reaper used for rapeseed harvesting. American-Eurasan J. Agric. & Environ. Sci., 2(4):388-394.