

Design of Waste Shredder Machine

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Abstract

The conventional agro-waste disposal is a traditional and oldest method of waste disposal in which agriculture wastes are dumped as it is to degrade in a particular place for decomposing. As the wastes are dumped as such, it takes more time to degrade and it causes environmental pollution. The waste shredder machine aims to reduce the agro waste and convert it into useful nourishing fertilizer. It decreases the man work making the farm neat and clean. Also it reduces the heap amount of pollution, disease causing agro-wastes and produces a better fertilizer with vermin compost.

The waste shredder machine is an attachment as like a ploughing attachment. In the shredder attachment input power and rigid support is provided by a KAMCO Tera-trac 4W tractor by means of PTO (power take off) shaft and three point linkage. PTO shaft of the tractor acts as a basic power input and the three point linkage provide a rigid support to the machine. Various kinds of blades are used for chipping and powdering operations like sawing blades, rotatory blades, and triangular shape blades. The blades are mounted on the shaft. The power is transmitted to another shaft by means of pulley and belt. For designing waste shredder machine, Creo parametric 1.0 software is used.

Keywords: Agro waste, Environmental pollution, fertilizer, vermin compost,PTO, Sawing Blades, Creo

I. INTRODUCTION

Agricultural production leaves considerable amounts of agricultural waste. Some of it is recycled into the agricultural production as fertilizer, while large amounts remain unused – and in many instances pose a disposal problem. Uncontrolled burning in the fields is not only a hazardous disposal solution - it is also wasting useful energy. With efficient collection systems, waste from agricultural production can be utilized as fuel for power and heat production. In some agricultural industries large amounts of biomass waste is already concentrated and readily available for utilization.

AGRO-WASTE

Agricultural waste, which includes both natural (organic) and non-natural wastes, is a general term used to describe waste produced on a farm through various farming activities. It has variously been estimated that these wastes can account for over 30% of worldwide agricultural productivity.

II. WASTE SHREDDER MACHINE

Shredder machine is used for shredding i.e. converting macro agricultural waste products into small or micro easily decomposable form, which can be used as organic manure. Any Organic matter which is considered to be a waste is not at all a waste. it can convert to any type of farm waste, garden

The boundaries to accommodate agricultural waste derived from agriculture and farming activities are identified in this. Examples will be provided of how agriculture and various practices adopted at farm-scale impact on the environment. When discharged to the environment, agricultural wastes can be both beneficial and detrimental to living matter and it will therefore also address the pros and cons of waste derived from agriculture in today's environment. Given agricultural wastes are not restricted to a particular location, but rather are distributed widely, their effect on natural resources such as surface and ground waters, soil and crops, as well as human health, will also be addressed.

Following sectors of agricultural waste utilization are presented in this section:

- Waste in Forest Industry
- Waste in Other Agricultural Industries
- Waste in Rice Industry
- Waste in Sugar Industry

waste etc...(Dry & wet) into highly nutrient organic manure by using shredder machine. (Bibhu Prasad Panda 2013).

It can shred hard and soft farm waste such as:

- Coconut husk
- Coconut frond
- Branches of trees
- Harvested banana trees

- Woods
- Leaves
- Peals

High quality Waste Shredder is designed to keep the environment pollution free by shredding waste materials. Solid Waste Shredder designed is perfect to shred all kinds of waste products.

The following are the salient features of our machine:

- The organic matter shredded will be in small pieces to enable the farmer to make use of the same for manufacturing direct manure/ organic manure and Vermin Compost
- Shredder can be operated with a Tractor - PTO Operated. The Power from the Tractor – 35 HP and above - is transmitted to the shredder assembly. The Assembly consists of one fixed blade and five circular blades
- The sturdy construction of machine assures the long life and durability of the machine

III. KAMCO TeraTRAC 4W tractor

Kerala Agro Machinery Corporation Limited (KAMCO), a state government enterprise marked its foray into manufacturing of tractors as a result TeraTRAC 4W (fig.1.1) formed and it Sensing good demand, the corporation plans to market tractors in domestic as well as overseas markets. The company is rolling out the tractors which feature a 15-HP diesel engine, power steering, and four-wheel drive. Its engine is KOHLER LOMBARDINI KDW 702 engine and it’s a water-cooled four stroke engine. It has two cylinders to get a continuous 11.5kw operation and having a displacement of 686 cc. Its engine power is 11.5kw at 3200rpm and PTO power is 10kw at 3200 rpm. This tractor has 9L of fuel tank capacity and it possesses three point hitches for linkage purpose



Figure.1.1 KAMCO TeraTRAC 4W tractor

Specifications

Engine	KOHLER LOMBARDINI KDW 702
Type	Diesel engine, water-cooled, four stroke
Power	Continuous 11.5kw
No.ofcylinders	2
Total displacement	686 cc
Engine gross power	11.5@3200rpm KW
Engine net power	11.5@3200rpm KW
PTO Power	10.0@3200
Fuel tank capacity	9 L
Hydraulic control system	Position Control Valve
Pump capacity	12L/min
Three point hitch	Category 1
Max. lift force at lift points	3000 N
24 in. behind	2400 N
Front tire	5.0*10" ,4 ply
Rear tire	6.5*16" ,6 ply
Weight	550kg
Overall Length	2236 mm
Overall width	875 mm
Overall height	1820 mm
Wheelbase	1228 mm
Minimum ground clearance	210 mm
Light Unit	12 volts, 40 Watts

Table.1.1 Specification of KAMCO TeraTRAC 4W tractor

Advantages:

- Waste shredder machine reduces the amount of agro-wastes from the farm and make the farm neat and clean.
- It converts the solid wastes which are too hard to decompose and digest to very small pieces and it will decompose easily.
- The agro waste causes so many environmental issues like Health hazard. It produces harmful substances such as sulphur dioxide (so₂), silicon dioxide (sio₂) and inhalable particles are emitted into the air in burning straws, that can be prevented it by shredder machine.
- Smog, as a result of straw burning gives rise to decrease in air visibility which has adverse impact on environment road traffic and aviation safety. This can be prevented it by using shredder machine.

- The output of the wastes is good for vermin-compost and it's a good bio fertilizer for cultivation.
- The bio-waste outputs can be used as a nutrient food for cattle and other domestic animals.

Application:

- The waste shredder machine can be applied not only in mass level but also small level agricultural field.
- The Coconut husk and Coconut fronds can be easily converted to small pieces and can be use as a good fertilizer for coconut cultivation.
- It can be used in forest industry to convert the heap amount of tree branches and leaves including peals to useful fertilizer or vermin-compost.

Power take-off shaft (PTO):

A power take-off or PTO (fig.1.2) is one of the several methods for taking power from a power source, such as a running engine, and transmitting it to an application such as an attached implement or separate machines. Most commonly, it is a system comprising a splined output shaft on a tractor or truck, designed so that a PTO shaft, a kind of drive shaft, can be easily connected and disconnected, and a corresponding input shaft on the application end. The power take-off allows implements to draw energy from the engine. Semi-permanently mounted power take-offs can also be found on industrial and marine engines. These applications typically use a drive shaft and bolted joint to transmit power to a secondary implement or accessory. In the case of a marine application, such shafts may be used to power fire pumps.[Kim 2008].



Figure.1.2 Power take-off shaft

PTO (Engine speed)	540,1000 rpm
Steering	Hydraulic
Transmission	4 Forward and 2 Reverse
Brake	Oil immersed
Minimum turning radius (with brake)	2.56 m
Traveling speed	17.74 max km/h

Table1.2 Specification of PTO shaft

Three point hitch

The three-point hitch most often refers to the way ploughs and other implements are attached to an agricultural tractor. The three points resemble either a triangle, or the letter A. Three point attachments are the simplest and the only statically determinate way of joining two bodies in engineering. A three point hitch attaches the implement to the tractor so that the orientation of the implement is fixed with respect to the tractor and the arm position of the hitch. The tractor carries some or all of the weight of the implement. The other main mechanism for attaching a load is through a drawbar, a single point, pivoting attachment where the implement or trailer is not in a fixed position with respect to the tractor. The three-point hitch (fig.1.3) is made up of several components working together. These include the tractor's hydraulic system, attaching points, the lifting arms, and stabilizers.

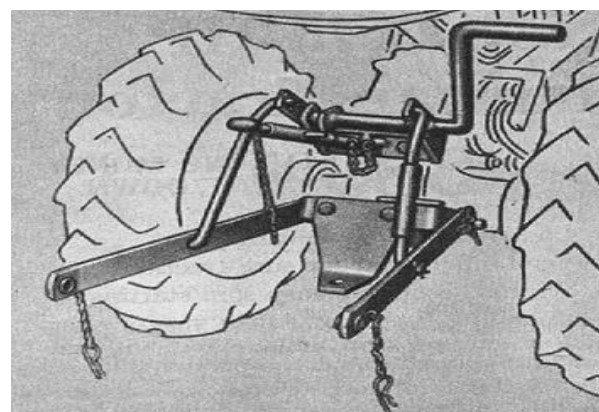


Figure.1.3 Three point hitch

Three-point hitches are composed of three movable arms. The two lower arms the hitch lifting arms are controlled by the hydraulic system, and provide lifting, lowering, and even tilting to the arms. The upper center arm called the top link is movable, but is usually not powered by the tractor's hydraulic system. Each arm has an attachment device to connect implements to the hitch. Each hitch has attachment holes for attaching implements, and the implement has posts that fit through the holes. The implement is secured by placing a pin on the ends of the posts.

IV. Design parameter Blades

The most important parts of the waste shredder machine are its blades. Various kinds of blades are used for chipping and powdering operations like sawing blades, rotatory blades, and triangular shape blades. The blades are mounted on the shaft.

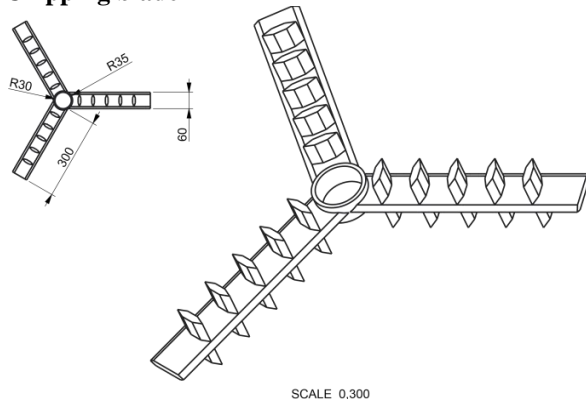
Crushing blade

(All dimensions are in mm)

Figure. 1.4 crushing blade

This blade is used for crushing the agrowaste. This blade is positioned on the top.
 Total length of the blade: 900mm
 Thickness of the blade : 50mm
 Consecutive distance between the blades: 66mm
 Radius of the blade : 165mm

Chipping blade

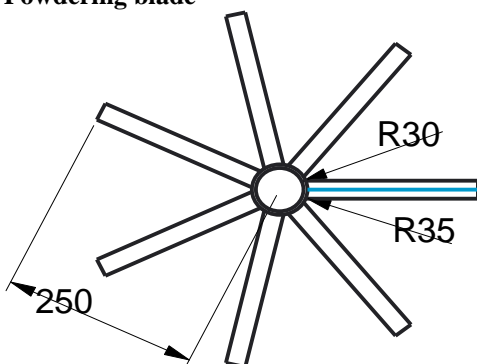


(All dimensions are in mm)
 Figure. 1.5 Chipping Blade

This blade is positioned in between the crushing blade and powdering blade. Main purpose of this blade is to cut the waste material into small pieces. Here we used two chipping blades on the shaft at different angles.

Length of the blade: 300mm
 Width of the blade : 60mm
 Sleeve radius : 35mm
 Shaft radius : 30mm

Powdering blade

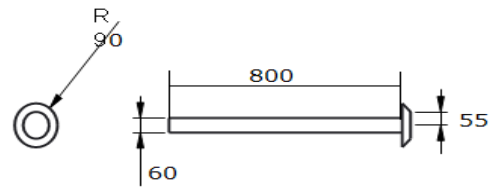


(All dimensions are in mm)
 Figure. 1.6 Powdering Blade

This blade is used for powdering the agrowaste to get maximum fineness. This blade is placed is positioned at the lower most part of the machine.

Length of the blades: 250mm
 Sleeve radius : 35mm
 Shaft radius : 30mm

Shaft



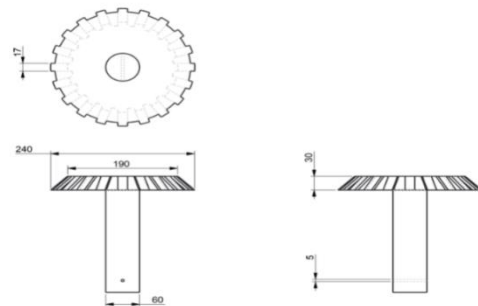
(All dimensions are in mm)
 Figure. 1.7 Shaft

Shafts is used for carrying two different blades and provide input power to the blade. Here, shaft is placed in horizontal manner.

Length of the shaft: 800mm
 Diameter of the shaft: 60mm

Bevel gear

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone.



(All dimensions are in mm)
 Figure. 1.8 Bevel Gear

Larger diameter of the bevel gear : 240mm
 Smaller diameter of the bevel gear: 190mm
 Diameter of the shaft : 60mm
 Thickness of the gear : 17mm

Protecting shield

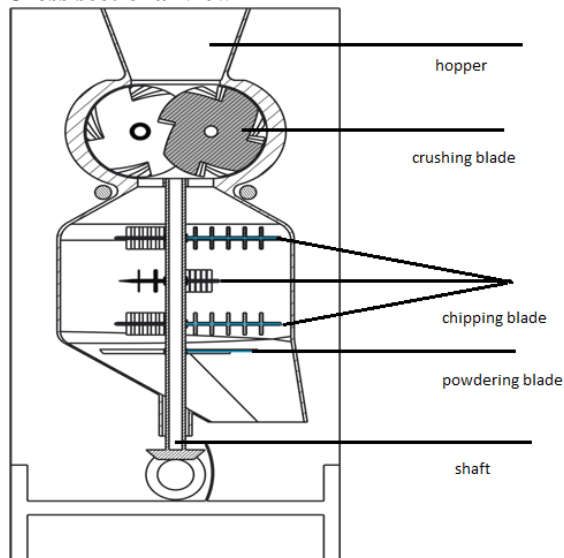


(All dimensions are in mm)
 Figure. 1.9 Protecting Shield

Main purpose of the protecting shield is to protect the worker from sudden accidents during operation. It also provide a rigid support to the machine

Length of the shield: 2000mm
Breadth of the shield: 1000mm
Thickness of the shield: 20mm

Cross sectional view



(All dimensions are in mm)

Figure. 1.10 Cross Sectional View

Above diagram shows the cross sectional view of the waste shredder machine. This diagram shows the clear arrangement of blades and shaft. Hopper is placed on the top of the machine to take the input waste. At the bottom a base is provided for having a rigid support to the machine.

V. Conclusion

This project provides a view of design about a waste shredder machine with respect to the specification features of 'kamco Teratrak 4w' tractor. The waste shredder machine will reduce the agro waste and convert it into useful nourishing fertilizer. Power input is taken from the power take off shaft (PTO) of the tractor. Three point linkages provide rigid support and reduce the vibration. It can also be used for the mobility of shredder machine. Power from the PTO shaft is transferred to the shredder machine by using guarded shaft. Speed can be increased by changing the gear ratio and it is possible to transfer power by using pulley and belt system. Various kinds of blades can be used for the chipping and powdering operations like sawing blades, rotatory blades, and triangular shape blades. These types of blades are used to attain maximum fineness. Creo parametric 1.0 which is convenient for

designing a 3D model, is used for designing the waste shredder machine.

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