Review in Modelling and Analysis of Rotavator Attachment for E-Car

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Abstract

In recent days, fuel cost is inflating to its peak as fossil fuels are in extinct, therefore slowly the researchers shifting their dimension towards E- Vehicle. As a technological updation, E-Vehicle begun to roll out saucerful in the field of agriculture. The use of E-Tractor in various agricultural process such as ploughing, sowing, etc. has a lot of advantages effect such as high efficiency, no fuel cost, no pollution, and user friendly to handle. Metal plougher, DC motor and solar powered electric battery are the main components of the E-Tractor. The shaft of the ploughing tool is attached to a high torque DC motor to plough the field. Due to the high torque of the DC motor the force required to plough the field is attained easily. The compactness of the E-tractor attracts the farmers who holds a small hectare of land. This article includes, design techniques involved in equipment like rotary tiller, rotavator blade and plougher. The survey reflects the respective design, analysis of equipment and also concentrated with performance of equipment when connected to high torque motor are detailed below.

Keywords: Smart Agriculture, Rotavator, Rotary Tiller, plougher attachment and E-Tractor

I. Introduction

Agriculture is one of the major and trending innovative investment cradle in current trend, because it is the first basic need of the humanity to survive. In the other hand, automobiles are the one greatest invention, of the mankind which serves humanity since his renaissance. Since the renaissance, major revolutions takes place in the development in the modification of automobile design. But in current trend, we are initiated to use the electric vehicles in all fields in maximized extent. Through our project, we are bringing the electric vehicle usage in the field of agriculture by the introducing the ROTAVATOR attachment in the electric car. The combination of rotavator attachment in the electric vehicle is new idea in the field of blooming E-vehicle usage in the agricultural field. Most of the researchers concentrated over the idea of rotavator's design, material and improvement in the internal properties of the rotary tiller tool.

A. *Rotary Tiller Design:*

Dae-Chun Kim [1] states that the PTO severity of an agricultural tractor during rotary tillage and baler service has been evaluated in this paper. Curves of S-N of through the fatigue life inspection, of PTO driving gears were obtained. In order to obtain the PTO driving gears' S-N curves, the breakage time and by observation of the bending stress with changing torque, the rotational speed of the gears was measured. During rotary tillage and baler operation, the torque acting upon the PTO was calculated and analyzed. At upland field sites with identical soil conditions, rotary tillage and baler operations were carried out at two ground speeds and two PTO rotational speeds, respectively. M.A. Matin et al [2] states that efforts to develop two-wheeled tractor strip-tillage drills have often used conventional bent rotating blades designed for full soil tillage disturbance, resulting in poor furrow backfill and smeared furrows.

The use of rotating straight blades with a range of cutting-edge geometries for cutting a 50 mm wide strip-till furrow was examined in this soil bin study. Amardeep Singh Kang et al [3] states a rotary tiller is a mechanized agricultural implement commonly used in soil bed preparation to save time, human effort and fuel. Nevertheless, tiller blades are subjected to extreme surface wear in complex abrasive environments, especially in dry sand, which significantly affects their service life. Amandeep

Singh et al [4] says that a rotary tiller is a mechanized agricultural implement commonly used in soil bed preparation to save time, human effort and fuel. Nevertheless, tiller blades are subjected to extreme surface wear in complex abrasive environments, especially in dry sand, which significantly affects their service life. The magnitude of overall vibration total value varies from 0.727 to 0.913 m/s2 among all the experiments. Analysis of variance (ANOVA) shows that forward speed and pulling force are significant at 5% level. The percentage contribution of forward speed, pulling force, and tillage depth is found to be 76.249%, 21.174%, and 1.794%, respectively. V.M. Salokhe et al [5] says that the experiments were conducted in a Bangkok clay soil to evaluate the performance of a rotary tiller equipped with reverse or conventional blades.

The conventional rotary tiller was equipped with C-type blades, while new blade types were available for the reverse-rotary tiller. Tests were conducted both on wet and on dry land. Tests were performed at forward speeds of 1.0, 1.5 and 2.0 km/h on the tractor. K. Chandra Moulia et al [6] states that the tillage is the primary and energy consuming activity in farming operations. The aim of soil tilling is to provide favorable soil conditions for seeding or transplanting by cutting and inverting the soil. Advanced tillage equipment is sold on the market. Poor farmers and those with small farms, however, cannot afford them because they are expensive to purchase and maintain. Yong-Joo Kim et al [7] says that The implementation optimum gear setting for the operation must be selected to boost the efficiency and reliability of the tractor during field operations.

The aim of this study was to examine the effects of gear selection on the load acting on the 75 kW agricultural tractor transmission and PTO shafts during rotary tillage at a tillage depth of 20 cm. In order to calculate the PTO-acting loads. Rajashekar M et al [8] one of the boring operations in crop production is weed control. Weeding is unfavorable due to labour costs, time and completely manual weeding. Efforts are therefore made to design and build effective farm machinery without using electric power to carry out weeding. This paper addresses modelling, modeling, research, production, and low-cost three-row weeder testing. Prathuang Usaborisut et al [9] states that reducing the use of energy in soil preparation has become increasingly necessary, as planting costs are high. In order to minimize the costs due to step-reduction in soil preparation, experiments were carried out with a hybrid tillage implement consisting of a subsoiler and a rotary harrow. As input factors in the analysis, three tillage operations, two forward speeds and two rotational rotor speeds were determined.

B. Rotavator Blade:

Moses Okoth Marenya et al [10] states that this tillage method raises the cost of land preparation because it involves a series of operations to realize an appropriate tilth standard using passive tillage equipment. The cost of land preparation is thus dramatically increasing. Therefore, better tillage tools must be built that are capable of reducing the number of tillage operations needed for the development of acceptable seedbeds. Ch. Ramulu et al [11] states in this agricultural fields, Rotavator has been used more and more. Rotavator blades need regular replacement under abrasive conditions for ground-engaging devices, resulting in increasing machine downtime and repair costs. On two distinct commercially available blades with tungsten carbide, Stellite-21 and chromium carbide coating materials, the electric spark coating (ESC) technique was evaluated to enhance their life. Coatings three different thicknesses of materials were applied to the blades. The wear loss of the second blade with tungsten carbide 4th mode treatment was around 0.80 percent less per hour than the other treatments for both blades. Amardeep Singh Kanga et al [12] says that complaint about the high wear rate of cultivator shovels often created by farmers and equipment operators in dry land agriculture areas. The recurrent labor, downtime and replacement costs of exchanging the worn out shovels are correlated with this elevated wear. The goal of this study was to improve shovel wear resistance by superimposing four distinct hard-facing electrodes on the leading edges of shovels made of EN45A steel.

Comparative field and laboratory wear tests were performed on a standard shovel and four hard-faced shovels, investigating the impact of hard-facing alloys on wear and shovel wear characteristics. Jyotirmay Mahapatra et al [13] states that the extremities were constrained by the value of the design and kinematic parameters used in the previous stage. In order to achieve the desired soil conditions and blade longevity, these restrictions were imposed. Using parameters from the selected combination, other design parameters were determined. The Rotavator configuration and kinematic parameters were determined to meet the above objectives. Ch. Ramulu et al [14], says in the agricultural fields, Rotavator has been used more and more. Coating materials were applied to the blades with three different thicknesses under abrasive conditions for ground engaging equipment. The wear loss of the second blade with 4th mode tungsten carbide treatment was around 0.80 percent per hour lower than the other treatments for both blades. S. Gebregziabhera et [15], says in addition, the sensitivity of draught and vertical forces to different pulling angles and the sensitivity to different rake angles of natural and tangential interfacial forces have been investigated. The draught force on the ploughshare was reported to have increased with the pulling angle.

Similarly, at the lower pulling angle, the tangential interfacial force of the implement was greater than the usual interfacial power. Prathuang Usaborisut et al [16], says two different soil conditions were used for the field experiments. Increasing the rotor speed from 299 to 526 rpm reduced the mean diameter of soil clods from 22.98 to 19.83 mm at a depth of 0-200 mm and from 31.77 to 26.57 mm for fields 1 and 2, respectively. The basic energy requirement was greatly influenced by the speed of the rotor and the tillage process. For fields 1 and 2, respectively, the basic energy requirements for the combined tillage with an on-frame pivot joint and a onpivotable-shank joint were lower by 10.4 and 21.1 percent and by 18.4 and 24.7 percent, compared with the total power requirement for the separate use of a subsoiler and a rotary harrow. Rajashekar M et al [17], states one of the boring operations in crop production is weed control. Due to labor costs, weeding takes time and is completely manual. Being unfavorable. Efforts are therefore made to design and build effective farm machinery without using electric power to carry out weeding. For safe architecture, finite element analysis is performed. The outcome shows that design technology based on simulation will shorten the time of design & development and the manually operated weeder cum feeder's functional efficiency result on loamy soil was 81.4 percent, clay soil was 86.5 percent, and on these soils, sandy soil was 89.4 percent.

C. *Ploughing:*

Dr. K. K. Jain et al [18], says that the rotavator is a tillage machine built to prepare soil appropriate for seed sowing (without soil overturning), to eliminate weeds, mix manure or fertilizer into soil, to break up and remove pastures for crushing clods, etc. Rotavator is a better application that performs the process at a time such as tillage, pulverization and land levelling. The study was therefore carried out to improvise rotavator operation with precise reference to reduce dust accumulation near the operator, including examination of rotavator field efficiency and attachment effectiveness.

Balaji Visvanath Bheeman et al [19], states that the rotavator plays a major role in soil tilling, which is the primary stage in the development of crops. Tillage is one of the most common, energy intensive activities of the method of agricultural production. Despite the flexibility of the rotavator, the material used for the construction of rotavator tines is found to wear out rapidly during field work at very high rates. After a meagre 60 hours of use, blades that cost an average of '150 on the market wear out. The blades are rather unaffordable considering the Indian agricultural sector, which has its farmers based in the rural areas. This work focuses on a frugal alternative and provides a viable option for low-cost, robust rotavator tines.

L.O. Brandsæter et al [20], states that the studies were carried out at two locations in Norway over a period of two and three years, respectively, and the procedures were replicated on the same plots. A stubble disc-harrowing cultivation time followed by mouldboard ploughing and only mouldboard ploughing were the soil cultivation treatments. Autumn or spring is the timing of the therapies. The abundance and biomass of the Cirsium arvense (L.) Scop., Elymus repens (L.) Gould, Sonchus arvensis L. aboveground shoots. Sukhraj Singha et al [21], says that hard-facing is an efficient method for enhancing the surface properties of metallic parts and tillage equipment. The wear resistance of modified and normal rotavator blades in the laboratory and in the real working region of sandy soil was tested in the present research. Hard facing is used as a procedure for surface modification and Cr-based electrodes are used for the investigation.

II. CONCLUSIONS

Based on literature survey, the authors concluded the points listed below.

1) The Rotavator components work under un-even miscellaneous forces of cyclic loading.
2) The texture and contour of the terrain and analyze the color sample from the terrain are the key to be considered before designing an equipment.
3) Due to the cyclic loading condition the fatigue strength and life of the blade is affected.
4) In order to improve the fatigue strength of the blade the design has to be modified and developed.
5) A.I. integrated multidisciplinary attachments are enabled in the E-vehicle for the future upgradation.
6) It's to be ensure the attachment, is coupled in the manner that the power to the E-vehicle movement is not interrupted.
7) The wear resistance property yet to be enhanced and after several investigation, Hard facing is adopted to improve the surface modification process.

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