Design and Analysis of Manual Rice Planter

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Abstract - Agriculture is most important sector of the Indian economy. It is most important source of employment for the majority of the work force in the country. Rice is primary and major crop cultivated in India. As the large workforce is engaged in this sector, Traditional method is costly, time consuming and labor intensive work. To make the transplanter system several attempt has been made to design and fabricate this machine. This study is focused on design analysis and fabrication of a manually operated rice planter for small scale Indian rice cultivators. By achieving the goals like simplifying the mechanism, reduce cost and reduced weight of present rice transplanter. The availability and use of manual rice transplanter in Western Maharashtra is very rare, so design of this project is useful to farmers.

Key Words: Rice, Transplanter

1. INTRODUCTION

India is a country of villages, having large population around two third of its population are dependent on agriculture. The sole culprit for slogging in pace of accretion in agro industry is dependency on traditional approaches and equipment.Technology refers to the application of scientific approach for practical purpose as well as industrial purpose for enacting and enriching goods and services. For the production of rice and onion, which is gradually a major production crop in Konkan the rice should be dropped at a regular interval. But the existing equipment does not fulfill these criteria in India. In existing system, plant are dropped manually at the cross point of longitudinal and lateral cultivation which increase the cultivation time as well as labor cost. But by this device both the operation i.e. cultivation and rice planting can be done simultaneously. In this system there is no need to drops the rice plant more than one times and no wastage of costly rice plants. And we save the production cost as well as cultivation time and labour cost to get more yields.. In future, this device will help the rice planter farmers of Konkan to change his life style. The rice trans-planter consists of prime mover, transmission mechanism, lugged wheels, rice ling tray, rice ling tray shifter, pickup fork and pickup fork cleaner. It is a walk behind type rice transplanted using mat type nursery and it transplants the rice ling uniformly without damaging them. The planting depth and start to end spacing can be adjusted. Automatic depth control helps in maintaining uniform planting depth

1.1 Basic Idea behind Rice Planter

Mechanical transplanting of rice is the process of transplanting young riceseedlings, which have been grown in a mat nursery, using a self-propelled rice trans-planter. In conventional manual transplanting practice, 8-12 labourers are required totransplant one acre. However, if a self-propelled rice trans-planter is used, three people can transplant upto 4 acres a day.

2. Mechanical Transplanting Of Rice

Manually operated translators are powered by man power. Operator has to move with the transplanter and power the machine by hand. These machines are small enough to operate manually.

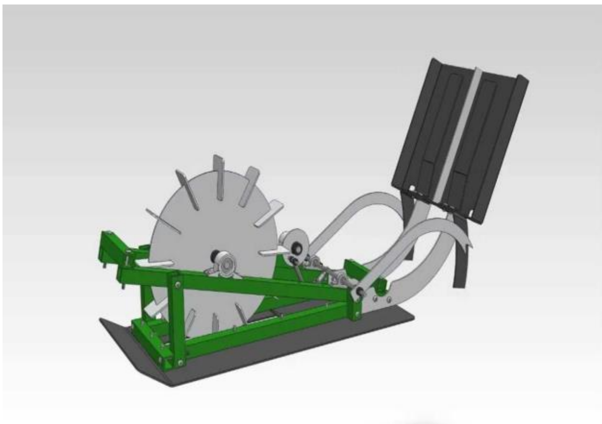

Fig -1: Name of the figure

2.1 Components of Rice Planter

1. Frame
2. Wheel
3. Sprocket & chain drive
4. Input Shaft
5. Slider crank Mechanism
6. Planting Arm
7. Gripper
8. Planter Arm
9. Intermediate Shaft
10. Output Shaft
11. Bearing

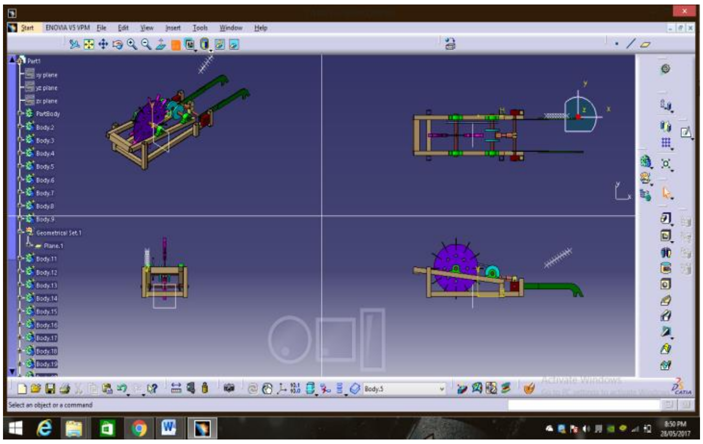

Fig-2. Views of Rice Planter

2.2 Input Shaft

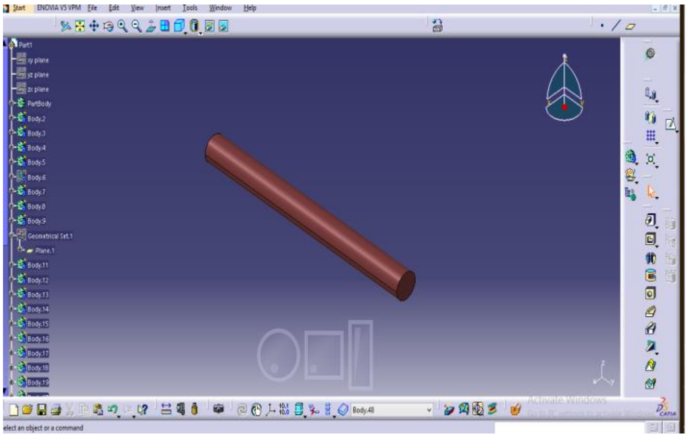

Fig-3. Input Shaft

- The motion is transmitted from the wheels to the input shaft and it further gives this motion to the intermediate and output shaft respectively which is connected to the planting arm with the help of chain drive and slider crank mechanism
- The wheel is mounted on input shaft and drive is provided by the rotation of the wheel
- The input shaft is subjected to bending and torsional moments and also horizontal and vertical loading.

2.3. Design of Input Shaft

2.3.1Properties & dimensions of input shaft-

I. Material used for input shaft-30C8

Sut= 600 N/mm2
Syt = 400 N/mm2
ςmax = 0.3*Syt = 120 N/mm2
ςmax = 0.18*Sut = 108 N/mm2

Thus ςmax = 108 N/mm² (minimum is selected)

$$Mt = \frac{60 * 10^6 * Kw}{2 * 3.1415 * N1}$$

Mt = 39788.7357 N-mm

$$Ft = \frac{2Mt}{di} = 1136.82\ N$$

$$Fr = Ft * \tan\alpha = 414.898\ N$$

2.3.2 Forces Acting on the Input Shaft For horizontal forces

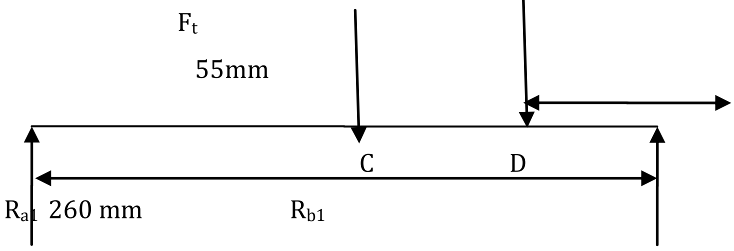

Fig-4 Horizontal Forces

ΣFy=0

$$Ra1 + Rb1 = 2 * Ft \quad ......(1)$$

And MA = 0

$$-Ft * 200 - Ft * 600 + Rb1 * 800 = 0 \quad (2)$$

Ra1 = 240.482 N
Rb1 = 896.338 N
MA = MB = 0
MC = -Ra1*130 =31262.66 N-mm
MD = Ra1*200 = -49298.59 N-mm

For Vertical forces

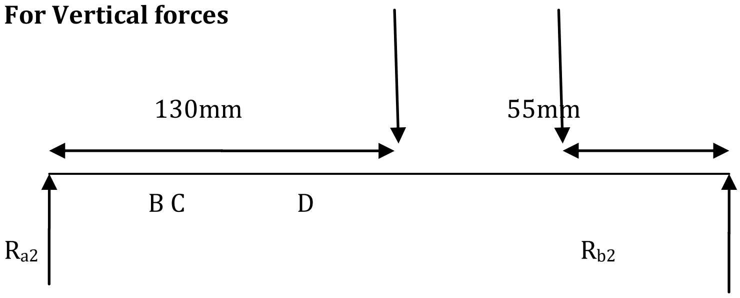

Fig-5 Vertical Forces

ΣF_y=0

$$Ra2 + Rb2 = 2 * Fr + mg$$

M_A = 0
R_{a2} = 97.57 N
R_{b2} = 336.94 N
$M_A = M_B = 0$
M_C= -R_a*130 =12684.1 N-mm
M_D= R_a*205+ mg*75 = -22819.39 N-mm
Bending Moment

$$Mc = sqrt(Mc)_H\hat{}2 + (Mc)\hat{}2)$$

M_c=33737.817 N-mm
M_D = 54323.802 N-mm
M_b= 33737.817 N-mm

$$Te = sqrt((Kb * Mb)^2 + (Kt * Mt)^2)$$

T_e=103963.1411 N-mm
$D^3=16T_e/(3.1415*\varsigma)$
D=22.98 mm
D=25mm

3. Analysis of the Input Shaft

By using ANSYS software we find out the FEA solution for the Input Shaft.

3.1 Maximum bending stress

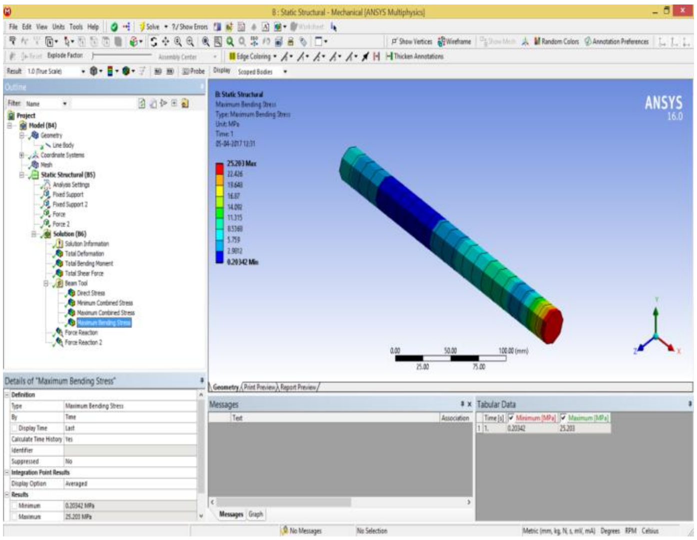

Fig-6 Analysis of input shaft(maximum bending stress)

3.2 Maximum combined stress-

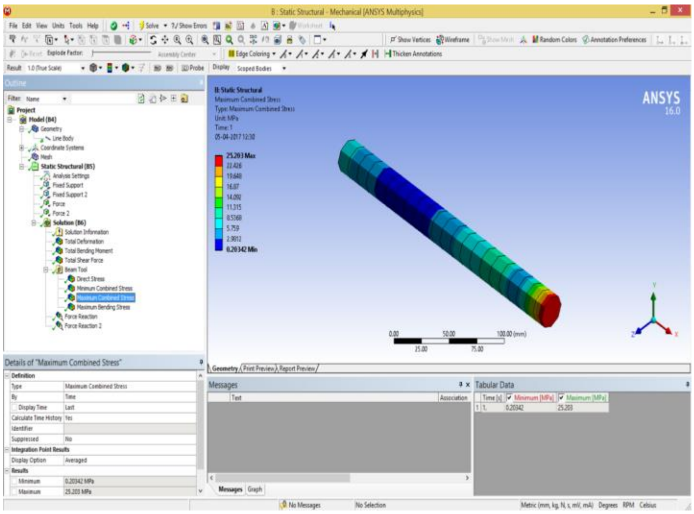

Fig-7 Analysis of input shaft(for combined stresses)

3.3 Total bending moment-

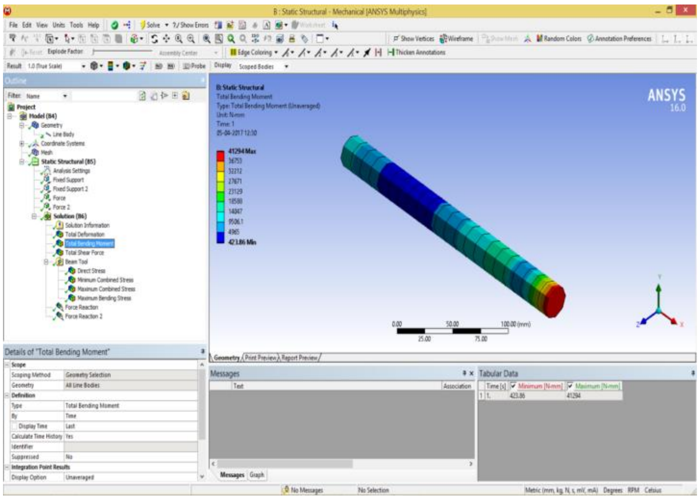

Fig-8 Analysis of input shaft(for total bending moment)

3.4 Total deformation

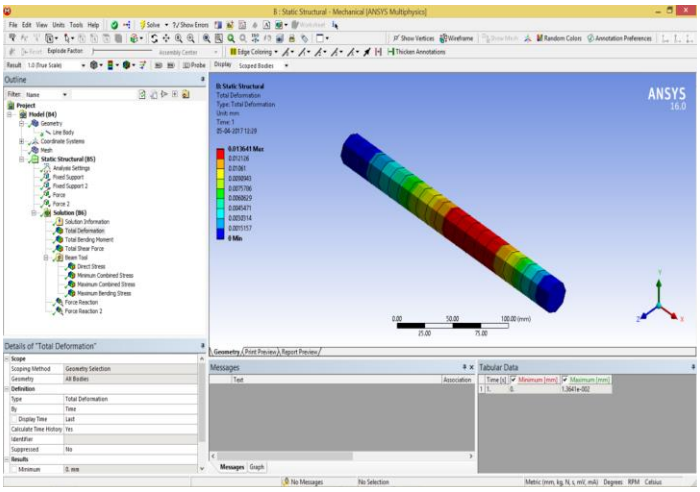

Fig-9 Total deformation

3.5 Total shear force

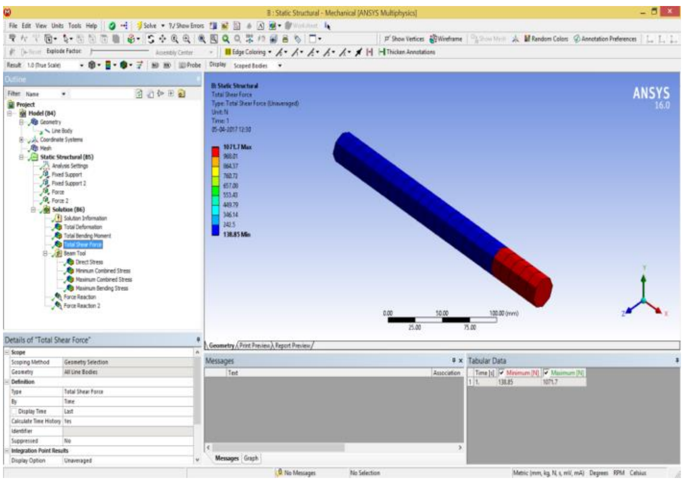

Fig-10 Total shear force

3. CONCLUSIONS

- The rice transplanter which we designed working is found to be satisfactory.
- Design of Input shaft is validated both analytically and by FEA also.
- Stresses and Deformation developed is within permissible value.

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