Design & Development of Agricultural Growth Nourishing Implementor (A.G.N.I)

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Abstract- Ever since man is walking on this earth and before he actually learned to communicate with each other an art of agricultural is being practiced by him. Agriculture is always been backbone to human economical development, impacted throughout its revolutionized India's stand on agriculture. Technology always has its role on these kinds of development. But as budding engineers our question always lied whether this technology has reached to all sectors of people. So in this paper we showcase our indigenous idea a concept of an agricultural machine, it's a multi-tasking machine mainly performs seven operation in farming, at a very economical cost. This proposed concept is designed and fabricated to a working scale, further to which this model analyzed. Analysis has been done to calculate the stress, strain & deformation and also theoretical calculations has been done. Comparison is done between the Ansys results & theoretical results. The design is performed by using CATIA V5 R20 Modeling software and the components are analyzed by finite element method (FEM) using Ansys software.

Keywords – Agriculture , design, technical features,FEM.

I. INTRODUCTION

Emphasizing on the design part, this paper comes in reference with "Research & Development" stream. Thus defining the significance of this machine in a simple way would profound and be difficult. But, to brief about the project can be defined as,
"A multipurpose machine, which can be used for different purposes in agriculture such as cultivation, seeding, planting or sowing, fertilizing".
Main purposes

- Tilling and ploughing
- Leveling
- Seed guiding
- Seed sowing
- Bund formation
- Fertilizing
- Carriage transportation

1.1 Tilling & Ploughing(cultivation & leveling):

This machine uses the help of a battery and an electric motor (electrical attachments which is provided depending on the requirement and field of usage) for its power, just like a tiller it can be used to remove the soil and immediately sow a seed or plantation purpose. The driving power produced will be used to move the machine to &fro and also to rotate and alter in the direction required. Further the tiller or the plougher can be adjusted to required level considering the depth needed and can be ploughed following which can leveled using a leveler attached to the same.

1.2 Seed drilling (guiding & sowing):

After a specific time period when sowing of seed has to be done, the same machine can be used to create a lane using a seed guider which impacts on the soil a pattern at a depth previously estimated. And following a seed is sown at alternate uniform distances accordingly in the lane produced. This plantation or sowing can be done in an order with the help of a seed funnel which is attached to a gear system. For every revolution of the main wheel, the gear wheel makes one revolution and thus for every revolution of the main wheel two seeds are sown or planting can be done. Thus for a particular interval, sowing or planting can be done.

1.3 Bund formation and fertilization(includes sprinkling of various fertilizers):

Later, the mud which is taken out is replaced into the soil by means of a mud tray. Further a bund can be formed either to replace the soil or to provide enough space for cultivation of the next following lane. And an attachment is provided to initiate fertilizing liquids precipitants and also for irrigation of more lanes, predominantly saving time and money.

II. SCOPE OF PRESENT WORK

This project emphasizes on combining the major requirements needed to achieve organized farming in an efficient way. This project deals with the operation of major necessities of farming such as tilling, leveling, cultivation, seed guiding, seed sowing, bund formation, and liquid fertilization. All the processes mentioned above can be used at once or can be used independently depending on the requirements. The main process and the scope of usage of each process will be interpreted and explained in the further stages. This indigenous idea helps farmers to become independent and self-reliant. Instead of spending on labor and other peripherals required for farming, a single machine would be enough to repeat the process and help to optimize small scale farming.

Further the process of working of each stages and application of each module would be discussed in the same format. This machine mainly emphasizes on optimizing the tasks such as tillage, leveling, cultivation, seed guiding, seed sowing and bund formation. All the mentioned tasks would be a major concern to all the farmers and agriculturists. Generally all the major tasks required would necessitate a single machine for each and hence would be a huge burden to a general farmer. This would make farmers to eliminate mechanized improvisation and further would may make them too loose interest in the art farming. Hence, keeping such aspects in our mind, we as a team of four have tried in coming up with a new design which would ease farming techniques and further improve efficient methods in agriculture.

This emphasizes a farmer owning a small acre of land to optimize his methods of farming and to invest more interest on farming techniques in the modern competitive world. A.G.N.I as a complex idea would particulate modern farming methods and would hence ease agricultural work. The main aspects required for farming would be covered in on complex idea i.e., A.G.N.I.

III. OBJECTIVES

- To mainly concentrate on low scale farming, which can be easily affordable for agriculturalist and farmers, owning less agricultural land.
- Concept of recycling and use natural power source (solar). Hence, the utilization of the machine in agriculture field is burdened.
- As A.G.N.I. is totally an automated work process the manual methods of agriculture can be partially eliminated which saves time and cost preferences.
- It is beneficial equipment for implementing in various agricultural fields with less working capital.
- A.G.N.I basically a multitasking machine saves “Time and Money”.
- This is an automated machine to enhance cultivation and agricultural methods.

IV. METHODOLOGY

The general structure of working process plan was estimated and will be elaborated in the following steps. This process plan consists of the major working steps under taken during the development of A.G.N.I.

4.1 Process Planning

- Survey on machines available in the present day.
- Planning and designing the major requirements of the project.
- Developing a 2D design and 3D model of A.G.N.I.
- Chassis development to a working scale.
- Development of various working stages in A.G.N.I.
  - Tiller and motor attachments.
  - Cultivator and motor attachments.
  - Funnel system and wheel attachments.
  - Fertilizing attachments.
  - Mud tray and leveler attachments.
- Electrical connections.
- Assembly.
- Testing of work process.
- Analysis and future development.

4.2 Plan of Work and Methodology:

The following are the step process adapted in design, development and creation of A.G.N.I

a) Defining Requirements:

Development of A.G.N.I. requires materials that available in the market. The utilization of these materials would result in an effective output.

Many of these parts have to be designed independently and created separately to accomplish the benefits as mentioned earlier.

The main design ideas have already been developed and according to our conclusion the designs may be further put to work and developed.

b) Gathering & Analyzing information:

We as a team have worked together to gather right and efficient information relevant to the betterment of A.G.N.I, as per our knowledge we have the optimized information to deal with the design and developing the project in an efficient manner.

We have consulted many industries in this field and have visited in person and have commenced on the working of several agriculture compatible machines that are in market in the present day. And hence forth from our guidelines and knowledge, several industries have come to our aid in implementing the design and establishing the output in the efficient manner.

c) Work and methodology involved:

Designing of A.G.N.I.: According to our references and information portrayed from various sources we have accomplished the design features of the assembly and all the individual parts that are to be involved in the making of A.G.N.I.

d) Development and work process:

On consultation of many small scale industries and other work experienced faculties in this field the fabrication and developing the whole machine is completed according the requirement of specifications during the process.

V. DEVELOPMENT OF AGNI

A systematic and sequential step were followed to foresee a complete A.G.N.I by strictly following the process planning prepared at the very beginning in order to avoid or scatter our track to reach the destiny. Initially the idea was brought into 2D sketch & 3D model. From this a actual development of A.G.N.I was brought to a working scale and started for fabrication

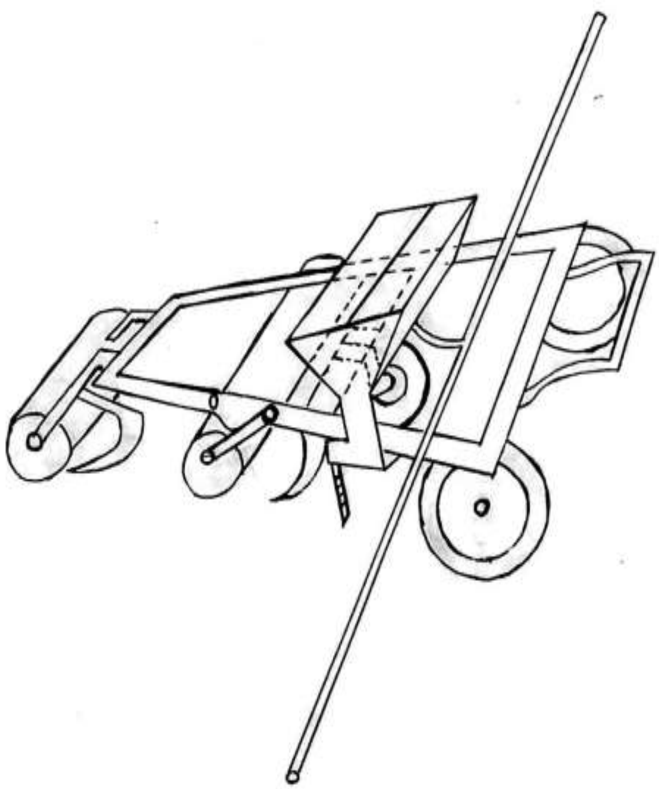

Fig-1. 2D view of A.G.N.I

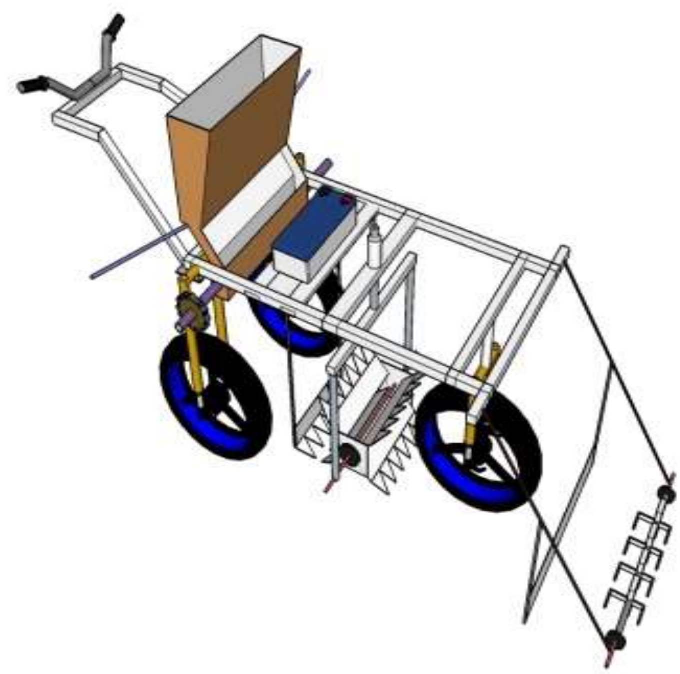

Fig-2. 3D View of A.G.N.I

5.1 FABRICATION OF AGNI

5.1.1 Chassis development

Subsequent units were developed separately and finally assembled together into one body-

- Tillage and attachments
- Cultivation and attachments
- Funnel attachments
- Fertilization attachments

1) Tillage and attachments

The initial working stage in farming is to convert hard soil into refined soil which contains necessary minerals for the better yield of the crops. This process of converting hard soil into refined soil is done by ploughing or in the modern age tilling is more suitable. This makes the use of a tractor with tiller attachments at its back. The tractor is generally driven by a man and tilling is carried in the necessary farming areas. Normally the work is carried out several times (2 or more) depending on the type of crop and type of soil used.

The process of traction is expensive and time consuming. Hence, farmers owning less acres of land (from 2 to 4 acres) go for further simplified method generally used in the present day known as the tiller. It's a machine normally used to till the soil. This process can be done independently by a farmer and consumes time depending on the land tropology and measurements.

For this purposes of tilling we worked on a sequential design which would perform the same task (i.e. converting hard soil into refined soil). This entity would consist of several blades arranged alternatively in a zig-zag manner. Similar blade attachments were arranged with equal distances from each. This attachment as a whole was further fitted to a hollow rod of 40 mm diameter. This hollow rod was further fixed with a pulley system consisting of a trapezoidal belt attached to another pulley with a motor driven on the other side. This tillage and motor attachment would be fitted to the chassis in the front end so as to perform the task of tilling. This task of tilling would be done with the help of the motor which drives the tillage attachments at necessary speed which is set as predetermined. For this purpose we have used a D.C motor of 12v which can run at a speed of 400-500 rpm. This motor would be powered with a 12v 40 amps battery which is fitted to the chassis at the rear end.

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Fig-3. Tiller attachments with pulley system

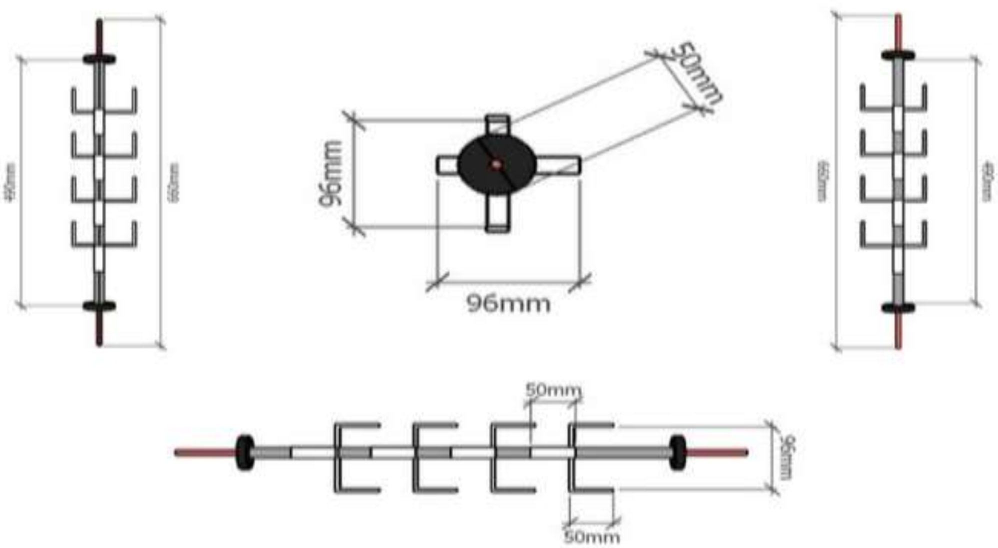

Fig-4. Tiller drawing

Technical specifications of tiller and attachments:

- Length of Tiller: 2 feet (60cm).
- Length of each Tiller blades: ½ feet (15cm).
- Depth covered at each stroke of Tiller: ¾ feet (22.5cm).
- Blade material: stain less steel.
- Pulley system with belt drive attached by motor on the other side.

2) Cultivator and attachments-

A Cultivator is any of several types of farm implement used for secondary tillage. One sense of the name refers to frames with teeth that pierce the soil as they are dragged through it linearly.

The main purpose of cultivating is to refine the soil after tilling process is undertaken. After several days or after week of tilling is accomplished, the soil is made to settle under the influence of sun. This makes to soil to gain more minerals and hence become more fertile. To enhance the soils fertility, cultivation is practiced. This process regains the soil and fertilizes the soil to the adequate level.

This consists of cultivator blades made of steel which are 1mm thick. Each blade consists of 6 teeth. These teeth generally enhance the fertility by bounding the soil from a much deeper layer to the upper most layers. This bounding is done by the influence of rotating such blades which are arranged in a systematic manner. Cultivator consists of 4 blades which are arranged in a square shape with the help of a square plate. Each corner of this plate is welded to a blade. Hence four corners have four blades. And further these are fixed to a pulley with a trapezoidal belt system attached to a motor drive. These cultivator blades are of 1 feet length each and can till up to ½ feet or 15 cm depth at each rotation. This bounds the upper layer with a much deeper layer which has more fertility. This gains the upper layer to achieve more minerals and enrich crop cultivation.

Fig-5. Cultivator assembly with pulley system

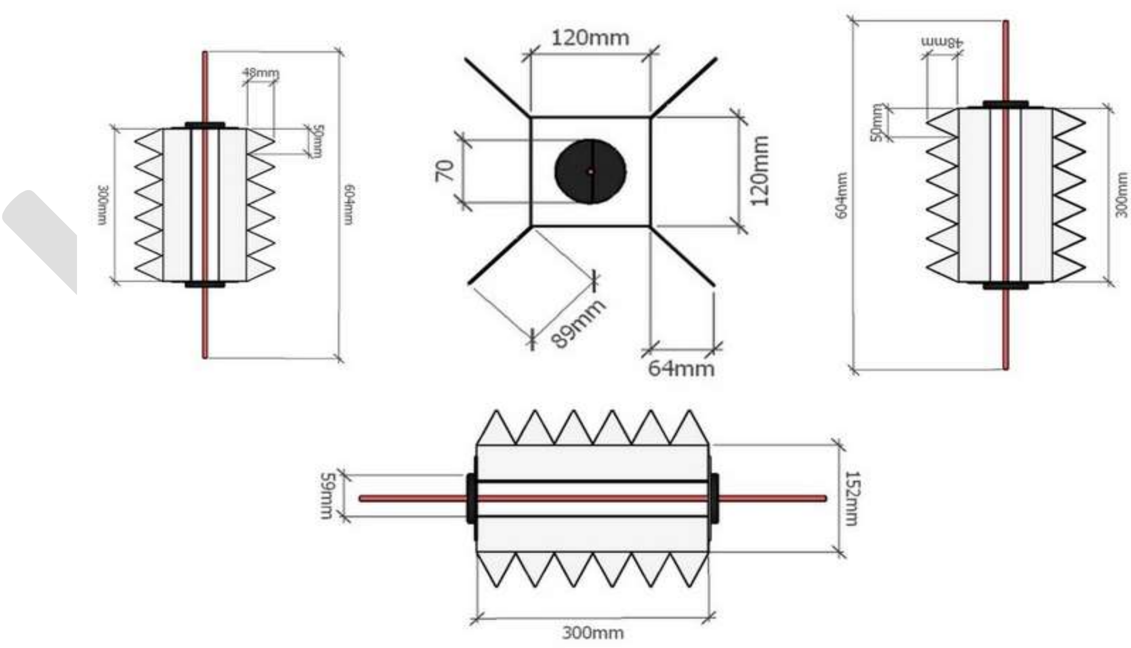

Fig-6. Cultivator drawing

Technical specifications of cultivator and attachments:

- Guider length: 1 foot (30 cm).
- Width of guider: 3/4 feet (22.5 cm).
- Blade thickness: 1 mm.
- Depth produced at each stroke: ½ feet (15cm).
- Blade material: Steel.
- Pulley system with belt drive attached to motor on the other side.

3) Funnel and attachments

After the lanes have been created, seeds should be sown at uniform adjacent distances accordingly. For the purpose of sowing, funnel and a sowing system was designed. This consisted of a funnel and a path at the lower frame for seeds to flow. As the seeds flow through this funnel, there should be a method to maintain the adjacent distances between each. This method can accomplished by a shaft carrying hollow cubes where each seed would drop at alternative time intervals and hence would be finally dropped to the soil by means of a pipe and a seed guider assembly. The hollow shaft is rotated inside a container which is followed after the funnel system. The rotation for the hollow shaft is provided through a chain mechanism whose one side of the link is attached to the rear wheels and the other to the hollow shaft which is provided with a free wheel.

Fig-7. Funnel attachment with lanes of seed flow

Technical specifications of funnel system:

- Funnel length: 2 1/2 feet (75cm).
- Funnel width: 1 ½ feet (45cm).
- Feed system: Manual feed.

- Material used: steel sheet(0.5mm thickness).

This mechanisms works with the chain drive attached to the rear-wheel. The hollow shaft consists of two spherical cavity placed on either sides(180°). For each rotation of the rear wheel the hollow shaft makes one full rotation and for each rotation of the hollow shaft the cavities containing seeds are dropped twice, which was collected previously from the funnel arrangement. Hence, for one complete rotation of the shaft, seeds are dropped twice from alternative cavities. As the shaft consists of 8 cavities (4+4 on either side of shaft) 4 lanes can be drawn and seeds will be sown in all the four lanes respectively.

Fig-8. Spherical cavity for seed carrying

Funnel Seed feed system:

- No. of feed units: 4 nos.
- Feed unit material: PVC pipe.
- System technique: gear system connected through chain drive to main wheel.
- For single rotation 2 feeds.

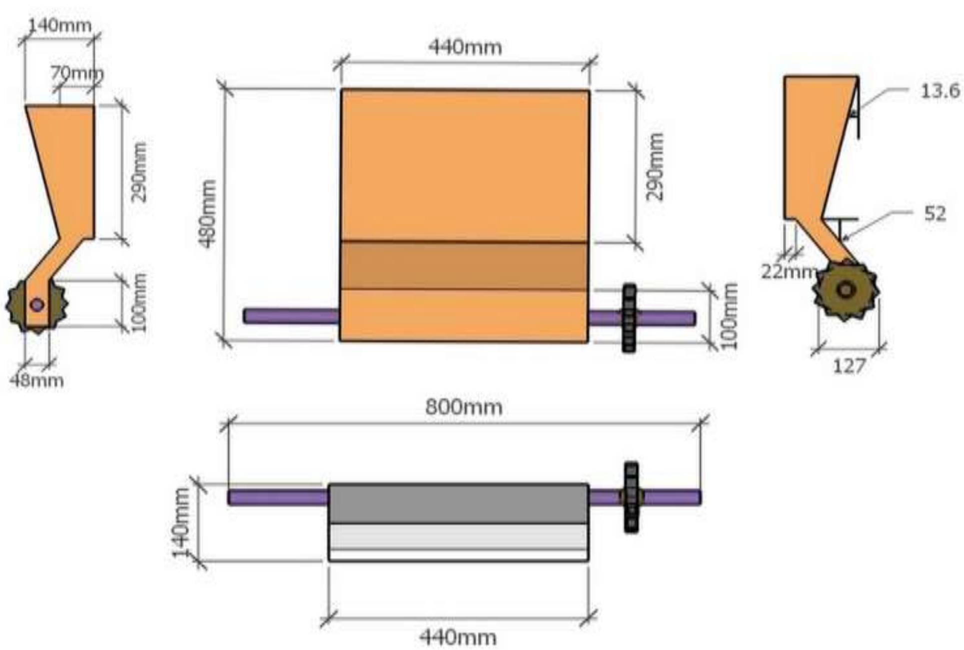

Fig-9. Funnel drawing

4) Fertilizer sprinkler

As the seeds are sown into soil at uniform intervals and bund formation has been completed, the next step is to irrigate the soil at right intervals. But for better yield of crops and to optimize the yield fertilization is widely practiced. This includes solid and liquid fertilization techniques. As the seeds are sown solid fertilizers are also scattered generally through the land area. This ensures more yields, and also to protect the growth of crops from insects and other harmful environment crops are often sprayed or sprinkled throughout the farming area. This purpose can be undertaken in A.G.N.I by placing a container which is supported by a pump. This pump contains the essential fertilizers; pesticides which are necessary can be sprayed with the help of a pump. This is placed after the funnel system, which can be operated by means of a switch. By operating the switch the pump can be turned ON/OFF whenever necessary. The function by turning on the pump is for spraying at required pressure which is supplied by the pump. The pump is connected to pipes on either side on the implementer; hence during the operation the liquid fertilizers are pumped through the pipes so as to spray to a distance as depending on the pressure.

Fig-10. Fertilizer tank with pump

5.2 ASSEMBLY OF A.G.N.I

The process undertaken at each module and their working were explained and justified in the above content. These modules are assembled to the main frame i.e. the chassis.

The assembly would be processed in the following manner:

- Tiller assembly at the front end.
- Seed guider assembly in the middle.
- Funnel assembly before the handle.
- Fertilizer sprinkler after the funnel system.

(i)

(ii)

(iii)

Fig-11. Projectile views of the final assembly(i) & (ii) Front, Rear views and (iii)Top view

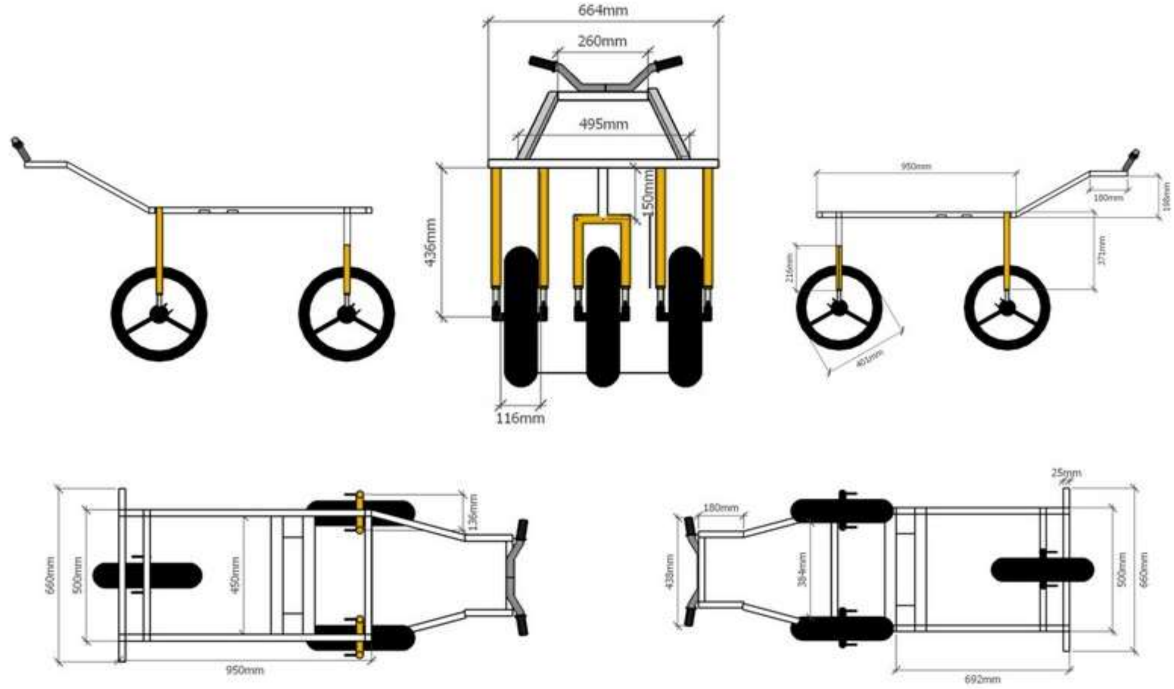

Fig-12. Assembly Drawing

Fig-13. Complete final assembly of A.G.N.I

VI. RESULT AND DISSCUSIONS

The main process involved in development of A.G.N.I was portrayed in the above content. After the assembly was finished several trail runs were undertaken and necessary changes were completed.

A completely assembled A.G.N.I involved the following features:

Tillage: This would initiate the process of converting hard soil into refined soil.

Leveler: As the tilling process was completed, the soil would be leveled to a certain medium as necessary by the usage of leveler.

Cultivator: This process involves secondary tilling.

Seed guiding: As cultivation is accomplished, lanes would be created with the usage of a seed guider.

Funnel assembly: The seeds are sown into the lanes created by the seed guider at uniform intervals by using the funnel assembly.

Bund formation: As the seeds are sown, bunds are created on the seeds to cover it with fertile refined soil.

Fertilization: The growth of the crops can be improved by efficiently utilizing liquid fertilizers.

In the above process, all the major objectives can be accomplished by the used a single complex idea i.e. Agricultural Growth Nourishing Implementer (A.G.N.I). Tillage and cultivator would be powered by a motor by using a battery. A.G.N.I should be handled manually by using a steering provided and operated by using the switch board provided to the handle to operate tiller, cultivator and fertilizer.

VII. CALCULATION AND ANALYSIS

Calculations are carried on the specific components of defined dimensions and material property with numerous working conditions. With the help specifically obtained mathematical models and basic Mechanics Of Machine formulae.

Analysis has been carried out by using finite analysis method with help of Ansys software. The analysis has been carried out in two stages. In the first stage the solid model of the component is selected and geometric conditions are selected, direction of the force is selected and results are evaluated using the software. In the second stage the boundary conditions are selected, then results are evaluated using the software

Analysis procedures

A typical analysis has three distinct steps:

- Build the model.
- Apply loads and obtain the solution.
- Review the results.

The procedure for a static analysis consists of these tasks*:*

- **Build the model**: The software permits the construction of the model from basic shapes. Alternatively a model from any compatible CAD software such as CATIA may be imported into Ansys workbench and analyzed. For the better understanding and visualization of the design 3D modeling has been done.

- **Set solution controls**: The different inputs regarding the preprocessor stage have to be input into the software. Some of the inputs are units, types of analysis, element type, meshing of the component etc.

- **Set additional solution options**: This includes adding the material properties and selecting the results desired from the analysis. Material property includes Material type, Poisson's ratio, Mass density, Yield strength and Elastic modulus.

- **Apply the loads**: The different types and the magnitude of loads are applied. Constraining the points over the component, where the component is clamped and then the load is applied considering all the necessary forces.

- **Solve the analysis**: Gives appropriate results as selected.

Review the results: The results are reviewed and the analysis is repeated by changing the variables if necessary.

7.1.1 CALCULATION OF TILLER BLADES

Material required: Hard steel

Motor power, N_c=0.5 hp

Blade span, w=75 mm

Blade thickness, t=6 mm

Blade angle, $\theta=90^0$

Blade cutting width, L_h=50 mm

Effective blade length, L_v=48 mm

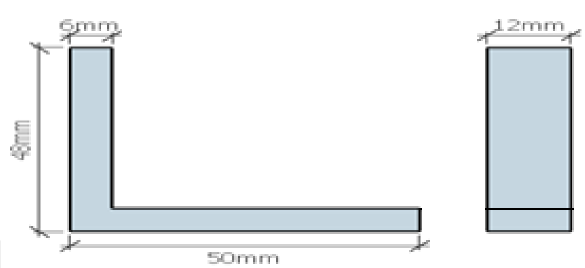

Fig-14 Tiller blade

Properties	Gray	CGI	Ductile
Tensile Strength (MPa)	250	450	750
Young Modulus (GPa)	105	145	160
Fatigue Resistance (MPa)	110	200	250
Heat Conductivity (W/(mK))	48	37	28
Hardness (HB)	179-202	217-241	217-255
Relative Damping Capacity	1.0	0.35	0.22

Table 1. Material properties

Theoretical calculations

For each blade,

Soil force (*Kc*)

*Kc = Ks*Cp/ i*Ze*Ne*

Where,

Ks=Maximum Tangential force(kg)

Cp= Co-efficient of tangential force

I = number of Flanges (16)

Ze=Number of Blades=4

Ie : Ne= 4/16 =1/4 = 0.25

Cp=1.5

Cs=1.5

*Ks= Cs*75*Nc*μc*n2/ Umin*

*Umin = πdn/*60 = *π**96*350/60000 = 1.76 *m/s*

Ks = (1.5*75*0.373*0.5*0.5) / 1.75

Ks =5.96 *kg* =58.5 N

Ie: Kc = (5.96*1.5) / (16*4*0.25) = 0.58 *kg* =5.48 N.

7.1.2 ANALYSIS OF TILLER BLADE

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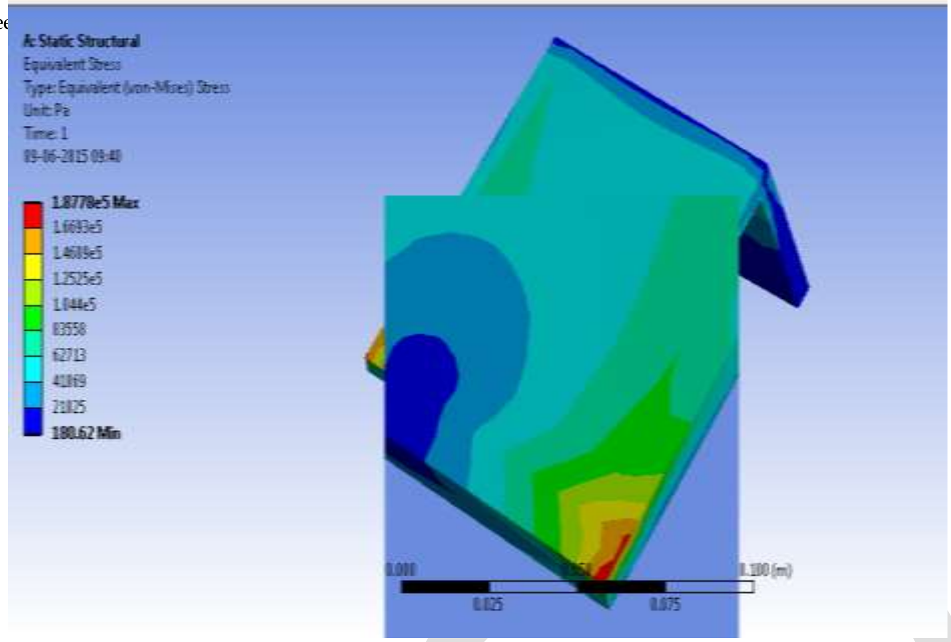


Fig-15. Equivalent stress on the blade

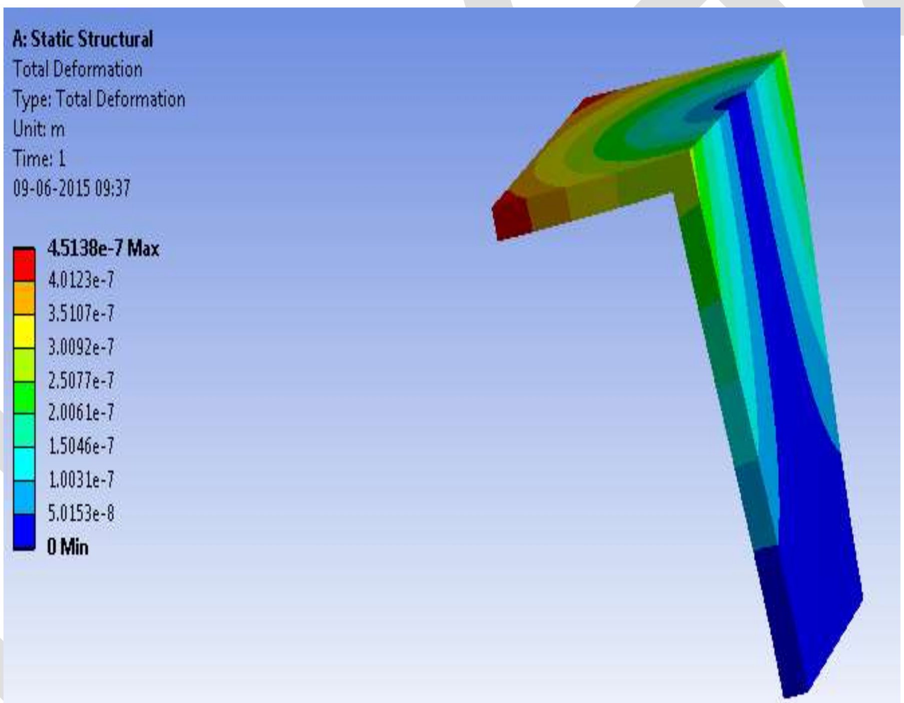


Fig-16.Equivalent elastic strain

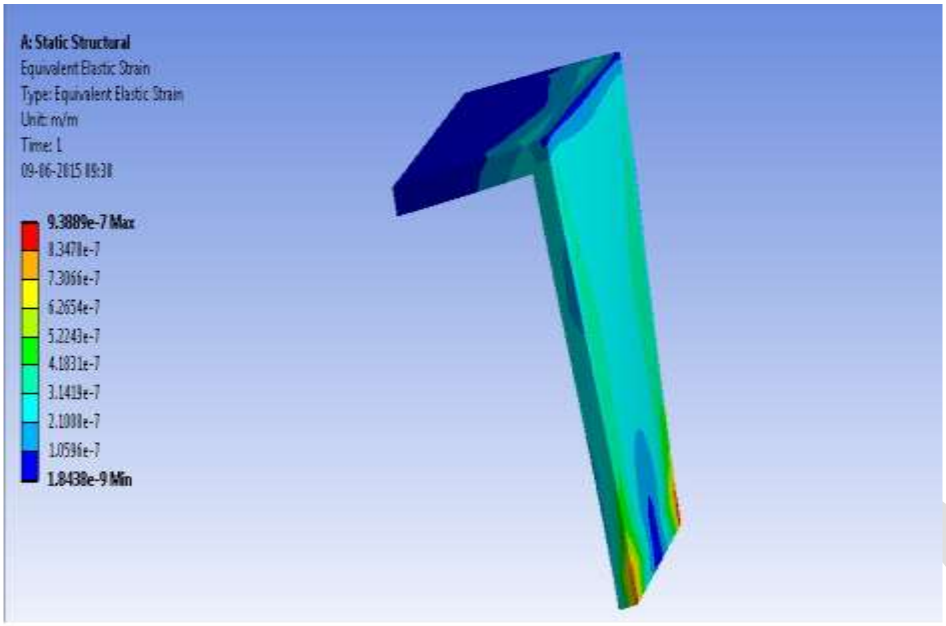
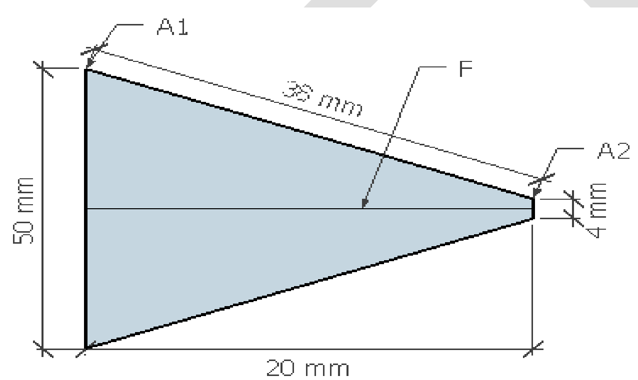


Fig-17. Total deformation

Result: The theoretical calculations are done are found conditionally matching with the results as obtained from Ansys workbench tool as shown above. The stress is found to b acting more at the corners

7.2.2 CULTIVATOR CALCULATIONS



Material required: steel plate

Motor power, *Nc*=0.35 *hp*

Blade span, *w*=50 *mm*

Blade Thickness, *t*=4 *mm*

Effective Blade length, *Lv*=20 *mm*

Fig-18. Cultivator Blade

Table 2. Material properties

Group	Steel name	Steel number	Tensile strength R_m [a]		Minimum yield strength R_{eH} for thickness t (mm)						Minimum elongation A on gauge length of $5,65\sqrt{S_0}$ [a]	Minimum average Charpy V-notch impact test value		Thickness maximum
			Thickness t (mm) ≤ 100	Thickness t (mm) > 100	$t \le 16$	$16 < t \le 25$	$25 < t \le 40$	$40 < t \le 63$	$63 < t \le 100$	$100 < t \le 150$		Temp.	Energy	
			MPa[c]	MPa[c]	MPa[c]	MPa[c]	MPa[c]	MPa[c]	MPa[c]	MPa[c]	%	°C	J	mm
1	S355G2+N	1.8801+N	470 to 630		355	345	-	-	-	-	22	−20	50	20
1	S355G3+N	1.8802+N	470 to 630		355	345	345	-	-	-	22	−40	50	40
1	S355G5+M	1.8804+M	470 to 610		355	345	-	-	-	-	22	−20	50	20
1	S355G6+M	1.8805+M	470 to 610		355	345	345	-	-	-	22	−40	50	40
2	S355G7+N	1.8808+N	470 to 630	460 to 620	355	355	345	335	325	320	22	−40	50	150[b]
3	S355G8+N	1.8810+N	470 to 630	460 to 620	355	355	345	335	325	320	22	−40	50	150[b]

Theoretical Calculations

Average Area:

Average area = $(A1+A2)/2$

Where A1, A2 are in mm^2

$A1$ = b1 * t in mm^2

$A1$ = 50*2

$A1$ = $100mm^2$

$A2 = b2$*t in mm^2

$A2$ = 4*2

$A2$ = $8mm^2$

$Avg = (A1+A2)/2;$

$Avg = (100+8)/2;$

$Avg = 54mm^2$

Bending Moment

$M_b = F*L$ N-mm

Where

F = static load in N

L = length of the blade in mm

L = 20mm

Static load

Power = $0.35HP$

Power = 0.35*.746

Power = $0.2611KW$

$P = 2\pi NT/60{,}000$

But $T=F*R$

$P = 2\pi NFR/60{,}000$

$0.2611=2*\pi*275*F*96/60{,}000$

$F = 0.0944N$

N = Speed in rpm

R = Radius from the shaft to blade tip

i.e., $R=96mm$

Bending Moment

$M_b = F*L$

$M_b = 0.0944*20$

$M_b = 1.88$ N-mm

Bending Stress

$M_b/I = \sigma_b/y$

I = Moment of inertia in mm^4

$I = bd^3/12=bt^3/12$

$b = (b1+b2)/2 = (50+4)/2$

$b = 27mm$

$t = 2mm$

$I = (bt^{3)}/12$

$= (27*2^3)/12$

$I = 9mm^4$

σ = Binding Stress N/mm^2

$y = 4/2$

$y/2 = (b1+b2)/2$

$y/2 = (50+4)/2$

$y/2 = 27$ mm

$y = 54mm$

$M_b/I = \sigma_b/y$

$1.88/9 = \sigma_b/54$

$\sigma_b = 11.28$ N/mm^2

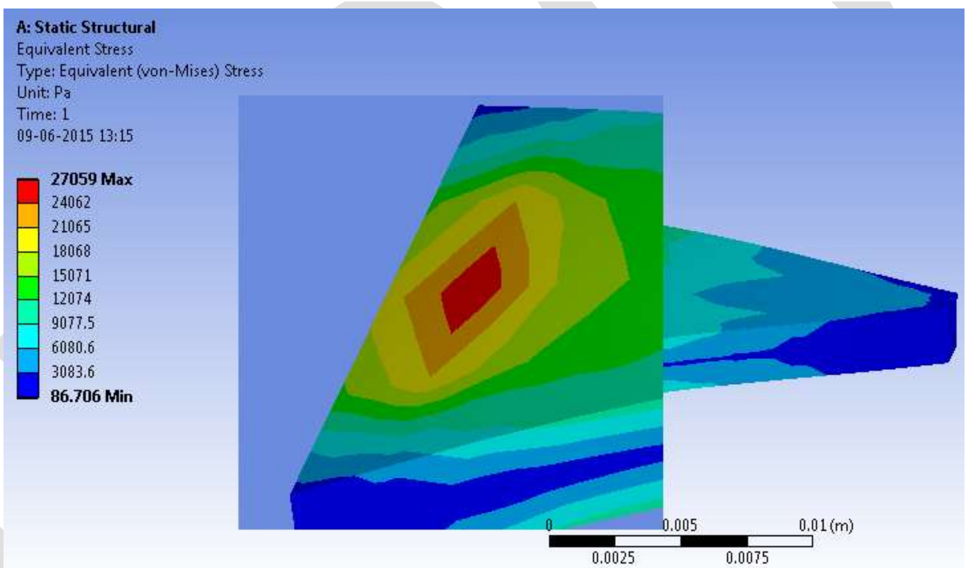


Fig-19. Equivalent Stress

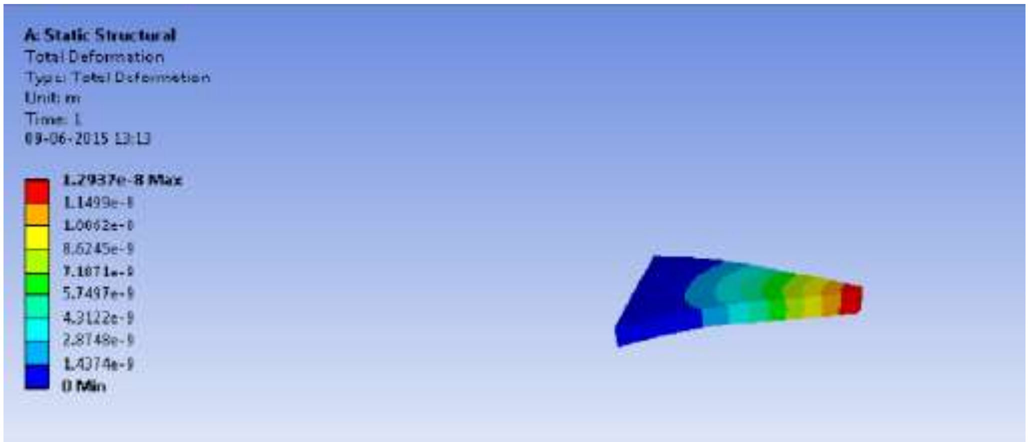


Fig-20. Maximum shear stress

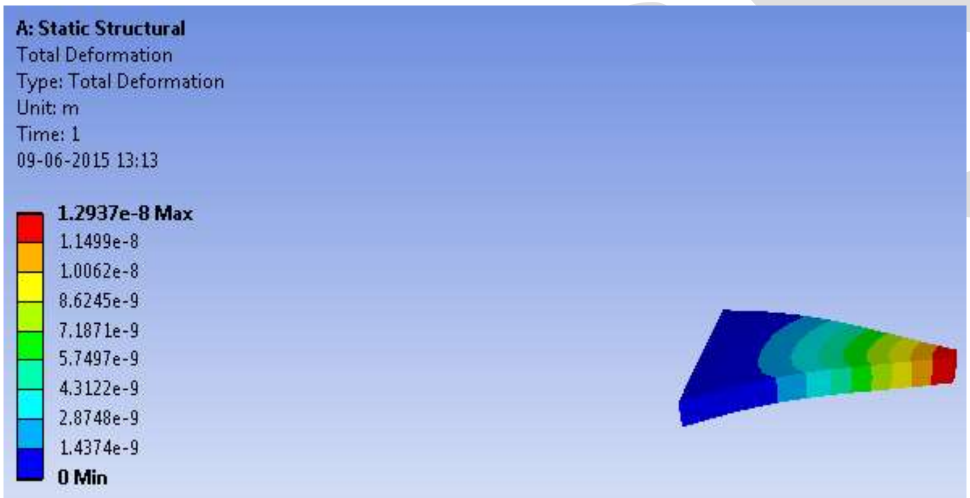


Fig-21. Total deformation

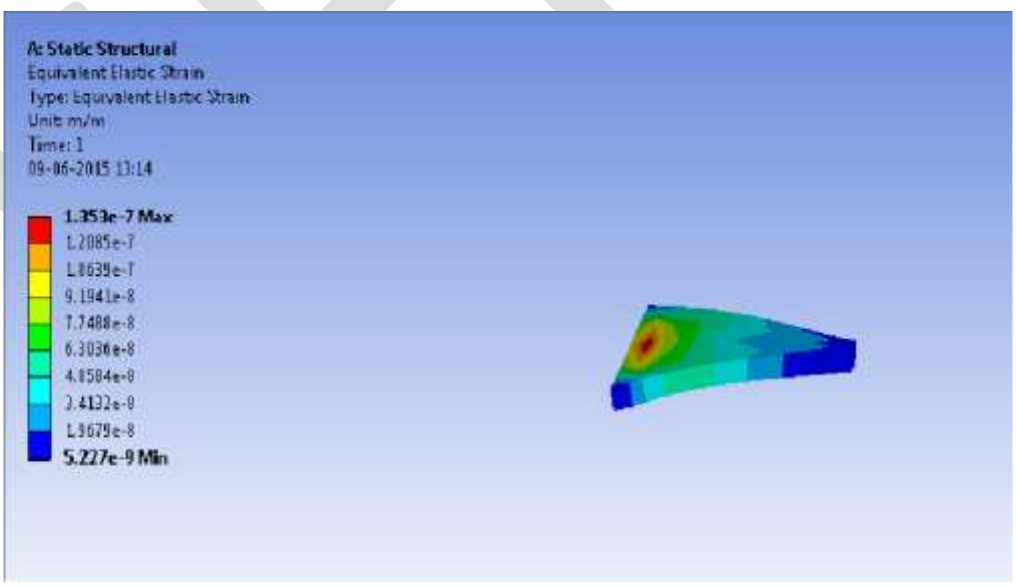


Fig-22 Equivalent elastic strain

Results: The theoretical calculations are done are found conditionally matching with the results as obtained from Ansys workbench tool as shown above. The stress is found to be acting more at the corners

VIII. BENEFITS AND LIMITATIONS

8.1 Benefits

- Due to advancement and implementation in the present working machines. A.G.N.I overcomes with more benefits and low initial investment.
- A.G.N.I compacted with numerous working benefits adapting multitasking technology and Indexing low maintenance cost.
- No need of maintenance of labor for work.
- A single machine can cultivate, sow, plant, seed, fertilizer, and harvest.
- No need of knowledge about the working of the machine.
- Easy working techniques.
- Serves for multipurpose at the same time.
- Increases growth of more crops and yield at less time.
- 70-80% more reliable than the present generation machines.
- Less seed consumption per acre compared normal machines.
- 30-40% of more yields.
- Less labor consumption. 5 people can do the work of 30 people hence saving Labor and time.
- Due to more reliability on water and fertilizer, decreases the cost on fertilizing and irrigation.

8.2 Limitations of A.G.N.I

As a working model is established and only a basic working principle is portrayed, the limitations as in general can be further estimated:

- Set up time consumption is moderate.
- Working knowledge is necessary.
- Time consumption for handling the equipment is moderate.
- Further automation would be beneficial.

Capital investment and maintenance cost is necessary and would be from moderate to high depending on the usage environment.

IX. SCOPE OF FUTURE WORK

- Completely automated machine which would optimize the working principles would ease operational methods.
- Solar powered A.G.N.I would be more beneficial as power fluctuations in rural areas is a general problem.
- Automating the working of tillage and cultivator by provided an rack and pinion or an hydraulic system would ease operational methods and would lessen time consumption.
- A fully featured A.G.N.I which can be controlled by a remote and operated in the same manner would invest a complete smart technology in farming.

- As A.G.N.I to the present, is practically a working model and the exact scaled model would be more efficient to work to an expected level of farming.

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XI. CONCLUSION

The conventional method of farming is moderate and has several benefits. But, when pertaining to a small scale agricultural aspect, generally most of the methods followed in the modern world do not portray much usefulness. And modernized agricultural methods make use of several working principles which would be investing more capital and less working benefits. As most of the machines of a particular purpose, much of the farming population cannot invest interest on technical methods of farming. Hence, in review of these aspects a multi-purpose machine which can be moderate and comfortable for low scale farming has been design and developed by us. This machine would be able to carry out most of the required aspects of farming at an individual to multiple working processes depending on the necessity.

A.G.N.I is a conceptual idea which is developed to a working scale and hence a general prototype has been designed and developed by our team. Further, by investing more interest A.G.N.I can be developed to a complete working scale and also can be sequentially optimized by automating the working concepts of the same.

REFERENCES:

[1] An Introduction to Agriculture by A.K. Vyas, Rishi Raj.

[2] Current State of Agriculture in India by golden peacock publications.

[3] www.wikipedia .com

[4] www.tutor.com

[5] www.usabangalore.edu.in

[6] www.biotecnika.org

[7] www.agricoop.nic.in

[8] University of agricultural sciences, Bangalore

[9] Gandhi Krishi Vignana Kendra (GKVK), university of agricultural sciences, Kodigehalli, Bangalore.

[10] Kisan Kraft machine tools private limited, Hebbal Bangalore.

[11] Subrata Kr Mandal, Dr. Basudev Bhattacharya and Dr.Somenath Mukherjee "Optimization of Design Parameters for Rotary tiller's Blade" Central of Mechanical Engineering Research Institute, Durgapur, India 1st International and 16th National Conference on Machines and Mechanisms (iNaCoMM2013), IIT Roorkee, India, Dec 18-20 2013