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# Design & Fabrication of Seed Sowing Machine with Water Sprayer

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**ABSTRACT:** In Agriculture, robots have many applications. Now a day's robots are used to decrease the efforts of human beings. These robots help to increase the efficiency. Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. In farming process, more labours are required to sow the seeds. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labour. The conventional seed sowing machine is less efficient, time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. The main aim of our project is to design and manufacture Machine to sow the seeds automatically so that the time required will be reduced and efficiency will be increased. The 3 D model will be drawn with the help of CATIA software. All the components will be manufactured and then assembled together. After making the assembly, the experimental testing will be carried out. After the testing, the result and conclusion will be carried out.

**KEYWORDS:** sowing machine, CATIA, 3D model.

## I. INTRODUCTION

### Introduction to Seed Sowing

The major occupation of the Indian rural people is agriculture and both men and women are equally involved in the process. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17% of world population from 2.3% of world geographical area and 4.2% of world's water resources. The present cropping intensity of 13.7% has registered an increase of only 26% since 1950-51. The net sown area is 142 Mha. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction over the seed.



Fig. 1 Seed Sowing in INDIA



The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agricultural and climatic conditions to achieve optimum yields and an efficient sowing machine should attempt to fulfill these requirements. In addition, saving in cost of operation time, labor and energy are other advantages to be derived from use of improved machinery for such operations. A traditional method of seed sowing has many disadvantages. This paper is about the different types of methods of seed sowing and fertilizer placement in the soil and developing a multifunctional seed sowing machine which can perform simultaneous operations.

#### TYPES OF SOWING

The following are the three different types of seed sowing

- **Broadcasting:** A field is initially prepared with a plough to a series of linear cuts known as furrows. The field is then seeded by throwing the seeds over the field, a method known as manual broadcasting. The result was a field planted roughly in rows, but having a large number of plants. When the seeds are scattered randomly with the help of hand on the soil, the method is called broadcasting.
- **Dribbling:** Drill sowing and dribbling (making small holes in the ground for seeds) are better method of sowing the seeds. Once the seeds are put in the holes, they are then covered with the soil. This saves time and labor and prevents the damage of seeds by birds.
- Another method of sowing the seeds is with the help of a simple device consisting of bamboo tube with a funnel on it attached to a plough. As the plough moves over the field the tube attached to it leaves the seeds kept in the funnel at proper spacing and depth. The plough keeps making furrows in the soil in which the seeds are dropped by the seed drill.

#### PROBLEM STATEMENT

In traditional process, more labours are required to sow the seeds. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labour.

#### OBJECTIVES:

- To design and develop the machine.
- To reduce the time.
- To increase the efficiency.

## II. RELATED WORK

BhushanDeshmukh&DurgeshVerma [1] This literature shows in the farming process, often used conventional seeding operation takes more time and more labor. The seedfeed rate is more but the time required for the total operation is more and the total cost is increased due to labor, hiring of equipment. The conventional seed sowing machine is less efficient, time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. In the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is also more and the total cost is increased due to labor, hiring of equipment. M.Aravindkumar, Akkarapallisanjeevreddy, k.sagadevan [2] This journal shows advancement in agricultural tools, is the fundamental pattern of rural change. This advancement in technology will not affect the nature of soil and increase the efficiency of getting crop. Nowadays the accessibility of work is a major problem faced by farmer. The proposed machine limits the working expense and furthermore decreases the ideal opportunity for burrowing seed sowing & irrigation operations by utilizing solar energy to operate the agribot. An adequate water supply is important for plant growth. When rainfall is not sufficient, the plants need additional water. Our undertaking encourages the ranchers to inundate the farmland in a proficiency route with computerized water system framework in view of soil dampness sensor. It depends on the edge esteem and the sensor esteems. This water system averts soil disintegration, spare water and can likewise supply manure to crops. The most essential procedure is it permits water preservation as water provided in a focused-on way close to the root zone. Seed sowing, digging & irrigation robot will proceed onward different ground shapes and performs burrowing, sowing the seed and gives a good environment for proper growth.Mr.Sagar B.S , Prakash Hullur , SangappaAnkush , VikramrajKannolli , VinayakRayakar [3] This review paper present brief information about semi-automatic seed



feeding vehicle. The main importance of this semi-automated seed feeding vehicle is to inseminate the seed as per the required depth with certain space and covering the seed with the soil with the help of closing jaw or furrow closer. And this machine is also used for the furrow in order to feeding the seed as per the depth. This semi-automated seed feeding vehicle will not affect the soil, it will increase the overall crop production. This machine reduces the effort and total cost of feeding the seed. Innovative Seed sowing equipment; has remarkable influence in agriculture. By using this innovative project of seed sowing equipment, we can save more time required for sowing process and also it reduces lot of laborer cost. It is very helpful for small scale farmers. Pankaj Kumar, G. Ashok [4] This Literature shows in agriculture, there is a need for a technology that is more easily understood, implemented and used by the farmers. Equipment that requires less human effort and time with less cost of implementation is much required for success in the agricultural industry. Seed sowing robot is a device that helps in the sowing of seeds in the desired position hence assisting the farmers in saving time and money. Seed sowing is one of the main processes of farming activities. It requires a substantial amount of human efforts and also time-consuming. This project aims to design and fabrication of the smart seed sowing robot for the mentioned task. This smart seed sowing robot consists of one robotic arm to sow the seeds from the seed container. The robot arm is controlled through the mobile application to get the desired positions of the arm. Once all the positions are set, the arm sows the seed automatically after the switching button ON. The wheel of the robot also controlled through the mobile application. Thus, this system completely automates the seed sowing process using a smartly designed mechanical system. This robot reduces the efforts and the total cost of sowing as the seeds. SangjinChoe, Yongsong Jang [5] This journal shows recently, laser pre-sowing treatment of seed is attracting a great attention of scientific community for its positive influence to enhance germination, seedling and growth of plants, vegetables and crops. In this study, effect of laser pre-sowing treatment of rice seeds was given, which was implemented by free-falling transport method. Test has been processed in Unzon district (DPRK) in 2017. Two kinds of Korean rice seeds (namely Pyongyang-53 and Dongsung-1) were irradiated by semiconductor laser with wavelength of 650nm, which was controlled in PWM mode. Each group was irradiated using exposure time of 0.28 seconds and duty ratio of 50 percent. In result, a considerable improvement has been observed in germination, growth and final productivity. Using laser pre-sowing treatment of rice seed, total productivities have been increased by 7.7% and 21% for “Pyongyang-53” and “Dongsung-1”, respectively. Results show that laser pre-sowing treatment of seed can significantly enhance germination, seedling and growth, and thus can improve the productivity of rice. In future research, laser pre-sowing treatment by free-falling transport method should be processed for other kinds of plants, vegetables and cereal crops to find out appropriate parameters, such as mechanical structure of device, wave length and power of laser, frequency and duty cycle of PWM control signal and exposure time, etc. Swapnil K Agrawal [6] This literature shows in the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labor, hiring of equipment. The conventional seed sowing machine is less efficient, time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. This paper deals with the various sowing methods used in India for seed sowing and fertilizer placement. The comparison between the traditional sowing method and the new proposed machine which can perform a number of simultaneous operations and has number of advantages. As day by day the labor availability becomes the great concern for the farmers and labor cost is more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer placement.



### III. EXPERIMENTAL RESULTS

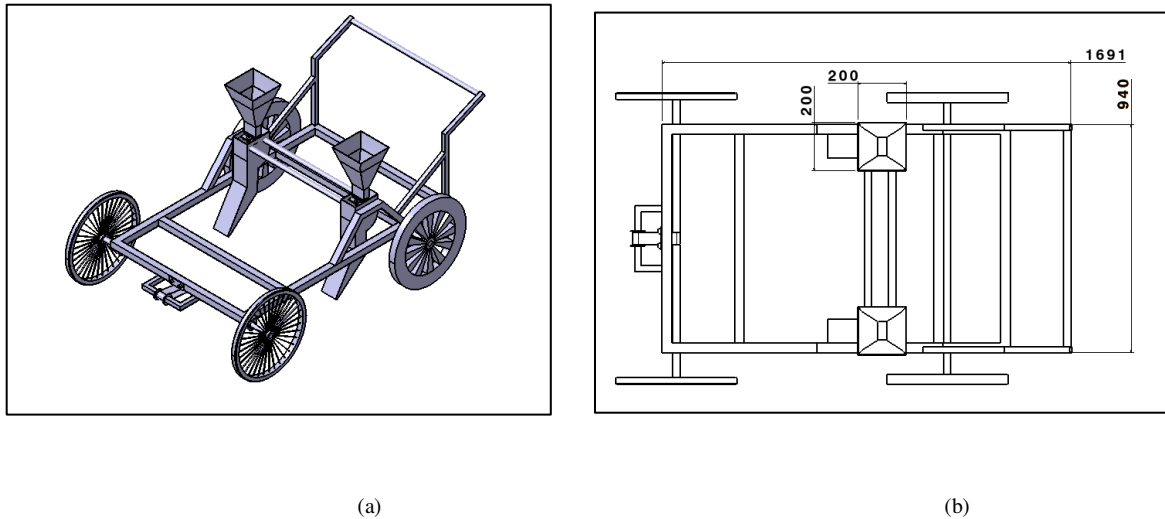


Fig. 2. Seed sowing machine (a), (b) CAD Model

#### BASIC CALCULATION:

Material selected for body Mild steel or low carbon steel, Square hollow pipe

Size of section: 25x25 mm

Thickness of section: 2 mm

Total weight of acted is considered as: 15 kg

$$= 15 \times 9.81 \text{ N}$$

$$= 147.15 \text{ N}$$

Weight on one hollow Square bar = 7.5 kg

$$= 7.5 \times 9.81 \text{ N} = 73.58 \text{ N}$$

$$x = y = 12.5 \text{ mm}$$

Area of cross-section is = 174mm<sup>2</sup>

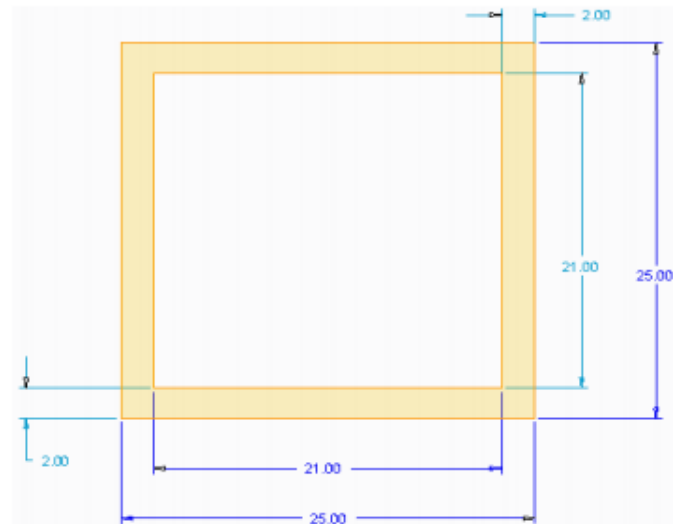


Fig.3. Cross section of bar(25X25)

As the load is distributed on the pipe which is subjected to the load as simply supported beam with uniformly distributed load the bending moment on the pipe is calculated as

$$M / I = \sigma_b / Y$$

$$I = BH^3/12 - bh^3/12$$

$$I = 32552 - 16206 = 16346 \text{ mm}^4$$

$$M_b = WL = 147.15 \times 1 = 147.15 \text{ N-m}$$

$$M_b = 147150 \text{ N-mm}$$

$$147150 / 16346 = \sigma_b / 12.5$$

$$\sigma_b = 112.52 \text{ N/mm}^2$$

Now, theoretical bending stress is given by the equation.

$$\sigma_b = \frac{\sigma_{yt}}{f_s} = 250 / 1 = 250 \text{ N/mm}^2$$

So the theoretical bending stress is more than the induced bending stress so the design is safe.

Another pipe we are using is 40x40mm Sq. pipe

Size of section: 40 x 40 mm

Thickness of section: 2 mm

Total weight of act on body : 30kg

$$= 30 \times 9.81 \text{ N}$$

$$= 294.3 \text{ N}$$

Assume that weight on one hollow sq. pipe = 15kg

$$= 15 \times 9.81 = 147.15 \text{ N}$$

$$X=Y= 20 \text{ mm}$$

$$\text{Area of cross section} = (A^2 - a^2) = 1600 - 1296 = 304 \text{ mm}^2$$



Moment of Inertia =  $BH^3/12 - bh^3/12 = 73365 \text{ mm}^4$

Distance of neutral axis = 20 mm

$M_b = wl^2/8 = 147.5 \times 12^2/8 = 18.44 \text{ N-m}$

18440 N-mm

$$\frac{M_b}{I} = \frac{\sigma_b}{y}$$

$$\sigma_b = \frac{18440 \times 20}{14800} = 24.91 \text{ N/mm}^2$$

Now, theoretical bending stress is given by the equation.

$$\sigma_b = \frac{S_{yt}}{f.s} = 250/1 = 250 \text{ N/mm}^2$$

So the theoretical bending stress is more than the induced bending stress so the design is safe.

Calculation of Ultrasonic sensor mechanism.

As we are taking the diameter of pulley = 30mm

So the perimeter of the wheel or pulley =  $2\pi r = 2 \times 3.142 \times 15 = 94.26 \text{ mm}$

So the half of the perimeter is covered by belt i.e.  $94.26/2 = 47.13 \text{ mm}$

## BELT LENGTH

The length of the belt is dependent on the diameters of both pulleys and the distance

Between their centers  $D = 161 \text{ mm}$

$$L = (d_1 \times \pi / 2) + (d_2 \times \pi / 2) + 2D + ((d_1 - d_2)^2 / 4D)$$

$$= (30 \times 3.142/2) + (20 \times 3.142/2) + (2 \times 161) + ((30-20)^2/4 \times 161)$$

$$= 47.13 + 31.42 + 322 + 0.155$$

$$= 400.705 \text{ mm}$$

So, to cover 5" of distance the pulley should rotate 1.5 times, i.e.  $540^\circ$

That means after the belt cover 127mm of belt length the object appears in front of proximity sensor.

PUMP:

Power spent directly on transmission of pumped fluid energy is calculated by the formula:

$$N_{II} = \rho \cdot g \cdot Q \cdot H$$

We calculate useful power consumed directly for medium pumping:

$$N_{II} = \rho \cdot g \cdot Q \cdot H =$$

$$Q = \text{Area} \times \text{Velocity}$$

$$\text{Velocity} = 2\pi N / 60$$

$$= 2 \times 3.142 \times 100 / 60$$

$$= 10.47 \text{ m/s}$$

$$A = \pi r^2 - \pi r^2$$

$$= 2.8274\text{E-}5 \text{ m}^2$$

$$Q = 2.8274\text{E-}5 \times 10.47 = 0.00029603 \text{ m}^3/\text{s}$$

$$N_n = 1000 \times 9.81 \times 0.00029603 \times 0.1 = 0.290 \text{ Watt}$$

MOTOR SELECTION:

Consider weight of the consumable = 1kg (approximately)

So, the force applied is equal to =  $1 \times 9.81$  newton.

$$F = 9.81 \text{ N}$$

Hence, the torque required =  $9.81 \times 0.05$

$$= 0.4905 \text{ Nm}$$

So, we have to select a motor having considerably similar torque as calculated.

DC motor:

Voltage = 12V, Current = 2Amp, Speed = 30 RPM

We know that,  $P = V \times I = 12 \times 2 = 24 \text{ W}$

$$P = 2 \times \pi \times N \times T / 60$$

$$T = 7.64 \text{ Nm}$$

## V. ANALYSIS

GEOMETRY:

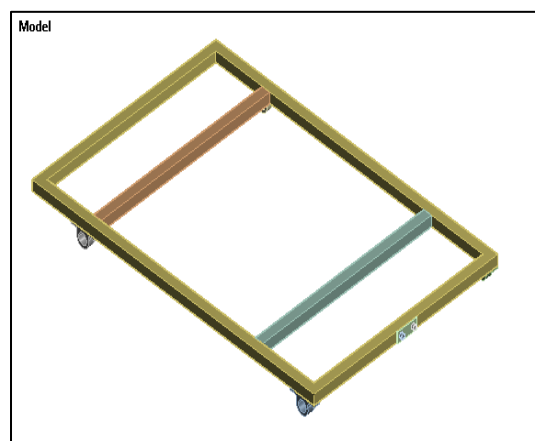


Fig.4. ANSYS MODEL OF BASE FRAME



MATERIAL USED:

Properties of Outline Row 3: Structural Steel			
	A	B	C
1	Property	Value	Unit
2	Material Field Variables	Table	
3	Density	7850	kg m <sup>-3</sup>
4	Isotropic Secant Coefficient of Thermal Expansion		
6	Isotropic Elasticity		
7	Derive from	Young's Modulus and Po...	
8	Young's Modulus	2E+11	Pa
9	Poisson's Ratio	0.3	
10	Bulk Modulus	1.6667E+11	Pa
11	Shear Modulus	7.6923E+10	Pa
12	Alternating Stress Mean Stress	Tabular	
13	Interpolation	Log-Log	
14	Scale	1	
15	Offset	0	Pa
16	Strain-Life Parameters		
17	Display Curve Type	Strain-Life	
18	Strength Coefficient	9.2E+08	Pa
19	Strength Exponent	-0.106	
20	Ductility Coefficient	0.213	
21	Ductility Exponent	-0.47	
22	Cyclic Strength Coefficient	1E+09	Pa
23	Cyclic Strain Hardening Exponent	0.2	
24	Tensile Yield Strength	2.5E+08	Pa
25	Compressive Yield Strength	2.5E+08	Pa
26	Tensile Ultimate Strength	4.6E+08	Pa
27	Compressive Ultimate Strength	0	Pa

Fig. 4.1 Properties of structural steel

MESHING:

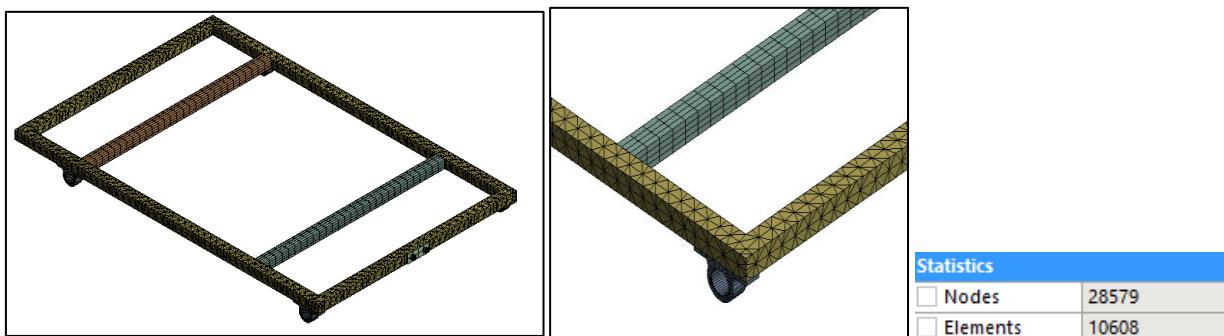


Fig. 4.2. Meshing

NODES AND ELEMENTS:

BOUNDARY CONDITION:

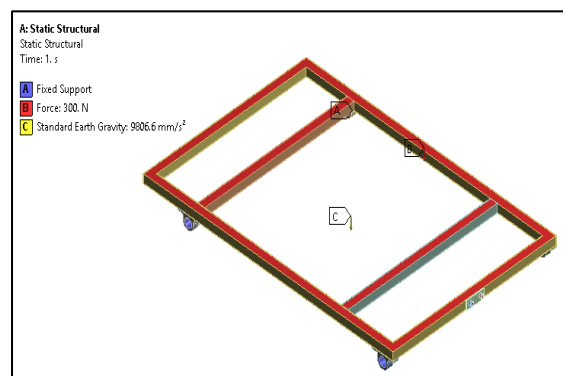


Fig. 4.3. Boundary conditions

we have applied 30 kg of weight on the chassis and gravitational force and we fixed the inner race area of bearing

#### RESULTS AND PLOTS:

##### TOTAL DEFORMATION PLOT:

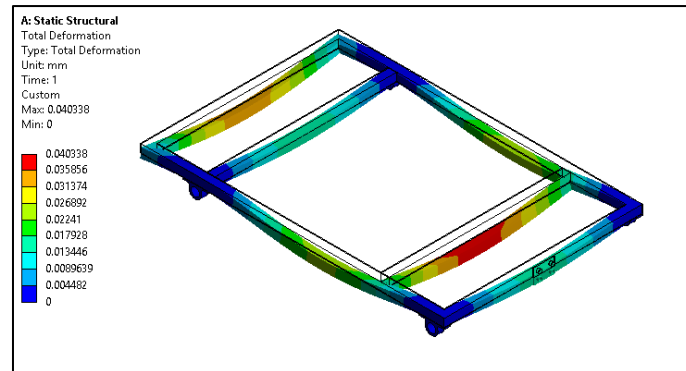


Fig. 4.4(a)

#### EQUIVALENT STRESS:

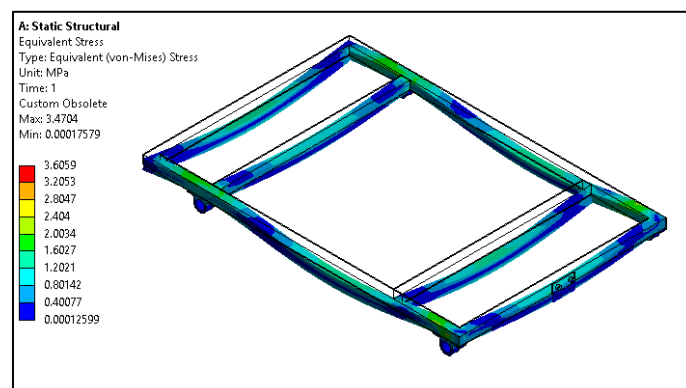


Fig. 4.4(b)

#### MAXIMUM PRINCIPLE STRESS:

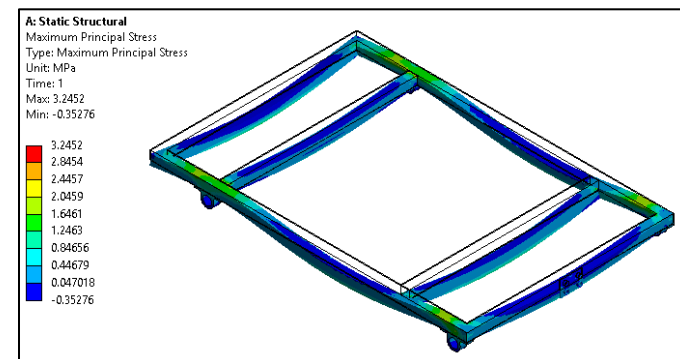


Fig. 4.4(c)



## VI. CONCLUSION

This project design and manufacturing of Seed sowing machine is fabricated on the idea of literature and research on completely different journal and paper relevantly on the market and fancied in accordance therefore it will offer flexibility operating.

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