

## Performance Evaluation of Ripened Chilli Harvester

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### ABSTRACT

India is the world's largest producer, consumer and exporter of chilli. In Indian subcontinent, chillies are produced throughout the year. Two crops are produced in kharif and rabi seasons in the country. Chilli grows best at 20–30°C temperatures, growth and yields suffer when temperatures exceed 30°C or drops below 15°C for extended periods. Chilli is believed to have been introduced to India by Portuguese explorers at Goa in 17<sup>th</sup> century. The developed prototype ripen chilli harvester was hitched to the high clearance tractor with help of two linkages and drawn in the farmer field at Murikipadu village in Guntur district to test the harvesting efficiency of chilli harvester. The power was transmitted to the double helical rollers from the high clearance tractor PTO. The prototype ripens chilli harvester was run with the all possible combinations of rollers speed and gap between two rollers like S1G1, S1G2 ..... S4G4. The prototype ripen chilli harvester was run for three time at each combinations of rollers speed and gap between rollers. The harvesting efficiency of prototype ripen chilli harvester was calculated by comparing the ripen chilli pods per plant before and after harvested with chilli harvester. The labour required for harvesting of ripen chilli varied from 350 to 400 man. day per acre. The approximate cost of labour for pickings per acre was Rs. 100000 and it is too expensive but mechanical harvesting was about Rs.1635 per acre.

**Key words:** *Chilli, Harvester, Hitching, Picking and Prototype*

India is the world's largest producer, consumer and exporter of chilli. Chillies are cultivated mainly in tropical and sub-tropical countries like India, Japan, Mexico, Turkey, United states of America and African countries. The fruit of chilli plants have a variety of names depending on place and type. It is commonly called chilli pepper, red or green pepper, or sweet pepper in Britain, and typically just capsicum in Australian and Indian English. The large mild form is called bell pepper in the US and Canada. It is called paprika in some other countries (although paprika can also refer to the powdered In Indian subcontinent, chillies are produced throughout the year. Two crops are produced in kharif and rabi seasons in the country. According to Directorate of Economics and Statistics of Andhra Pradesh 2014-2015 statistical data, it was cultivated in 1.35 lakh hectares and produced about 7.40 lakh tons of chilli with productivity of 5480 kg per hectare.

Residual Andhra Pradesh is producing 1/4<sup>th</sup> of total Indian chilli and has got 1<sup>st</sup> place for its production. Guntur, in the South Indian state of Andhra Pradesh, produces 30% of national production. Farmer have to invest more money on harvest of chilli crop as it being a labour intensive operation and coincides with peak harvesting season of other crops and hot weather conditions are further increases cost on labour wages. Mechanization is only the way through appropriate technology need to be developed to make farmer as profitable as possible and reduce the cost of harvest. Chillies have been traditionally harvested by hand.

Workers pull fruit from the plant and snap the stem off, placing the Chillies in the plastic bucket. However, hand harvest is not a perfect system. Cost of chilli harvesting reduced and production is economical due to availability of appropriate machinery for harvest. Till today, those kinds of machines are not developed in India. Different international companies like Oxbo, Boese, Sweere etc. are manufacturing chilli harvest machines and they are selling their products in the international market. These machineries are mainly developed for bold varieties of chilli. But, India has unique cultivation conditions for slender chilli varieties and these machines cannot be adopted directly for our varieties. Hence, it is dire essential to develop a chilli harvest machine those are suitable for Indian cultivars and conditions. To develop a chilli harvester which is suitable for Indian farms and varieties, the present research is undertaken with following specific objectives.

### MATERIAL AND METHODS

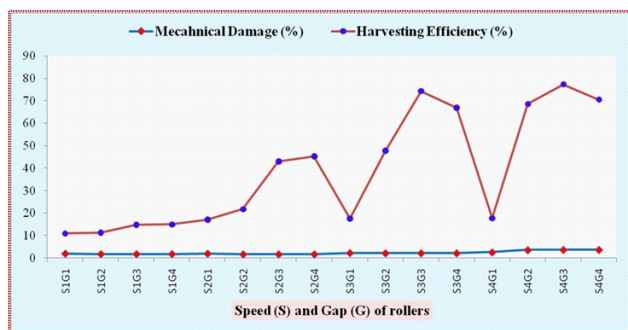
The experimental chilli harvester was tested in the college experimental plot to evaluate the field performance of harvester. The experimental chilli harvester was hitched to the high clearance tractor at the rear side with two point linkages to drag the harvester in the field. The double helical rollers were operated with electrical motor power. The electrical power supply was taken from the nearest source and used 50 m wire for conducting different experiments to optimize design features of the harvester. The chilli

**Table 1. Number of ripen chilli pods per row after and before harvested at 289 rpm**

S.No	Number of harvested ripen chilli pods per 30 plants							
	Gap1 = 320 mm		Gap 2 = 330 mm		Gap 3 = 340 mm		Gap 4 = 350 mm	
	Before	After	Before	After	Before	After	Before	After
Total	4486	4083	4460	4038	4562	3966	4520	3922

**Table 2. Interaction effects between gap and speed of rollers**  
**Dependent Variable: Harvesting Efficiency**

Gap (mm)	Speed (RPM)	Mean	Std. Error	95 % Confidence Interval	
				Lower Bound	Upper Bound
320	289	8.983	0.21	8.555	9.412
	393	15.227	0.21	14.798	15.655
	481	15.073	0.21	14.645	15.502
	658	15.39	0.21	14.962	15.818
330	289	9.543	0.21	9.115	9.972
	393	20.613	0.21	20.185	21.042
	481	45.67	0.21	45.242	46.098
	658	65.1	0.21	64.672	65.528
340	289	13.577	0.21	13.148	14.005
	393	41.737	0.21	41.308	42.165
	481	72.783	0.21	72.355	73.212
	658	73.327	0.21	72.898	73.755
350	289	13.453	0.21	13.025	13.882
	393	43.353	0.21	42.925	43.782
	481	64.527	0.21	64.098	64.955
	658	66.593	0.21	66.165	67.022



**Figure 1. Effect of speed and gap of rollers on performance of chilli harvester**

harvester was set in such way that the double helical rollers of chilli harvester will reach both sides of the plant to cover the entire chilli plant in a row. The machine was tested by varying (1) Forward speed of the operation (2) Revolving speed of the helical rollers

and (3) Spacing between helical rollers. The field layout of Continuous, turn strips at each end was the one of the best layouts to test performance of chilli harvester and it required 48 rows to test it with different combinations of operating parameters.

**RESULTS AND DISCUSSION**

The experiment was conducted to optimize the rotational speed of the rollers. Five numbers of pulleys with different diameters were selected. One small pulley size 90 mm was fixed to the prime mover and remaining pulleys were changed on the roller shaft to attain the different rotational speeds of rollers. The machine was run with forward speed of 2 km. h<sup>-1</sup>. The ripen chilli field was selected which was having the 30 numbers of plants in a row. The total number of ripen chilli pods were counted for entire row before and after harvested with chilli harvester.

The chilli harvester was run by keeping the rotational speed of rollers 289 rpm. The machine was run for three times at same rotational speed of roller and average value of harvesting efficiencies were computed at four spacing (320 mm, 330 mm, 340 mm and 350 mm) between two rollers. The average number of ripen chilli pods before and after harvesting were given in the Table 1. The harvesting efficiency of machine was calculated at all rotational speeds of rollers with variable gaps between rollers. The machine was run for three times at each combinations of operating parameters of machine and data was analyzed with SPSS to get the best combinations of operating parameters shown in the Table 2.

The highest harvesting efficiency 73.32% of prototype ripen chilli harvester was got at the combination of speed 658 rpm and gap between the two rollers 340 mm with minimum mechanical damage to the harvested ripen chilli pods. The maximum harvesting efficiency 73.75% of chilli harvester was got at rotational speed of rollers 658 rpm with optimum gap between rollers 340 mm. The harvesting efficiency of machine was less at fewer gaps between rollers 320 mm as well as at gap between the rollers beyond 340 mm.

The harvesting efficiency of chilli harvester was increased and reached to the maximum efficiency with increased rotational speed of the rollers. The maximum mechanical damage of the harvested ripen chilli pods was 3.6% at maximum harvesting efficiency 73.75% of chilli harvester with optimum operating parameters of chilli harvester were speed of rollers speed 658 rpm and gap between two rollers 340 mm. The harvesting efficiency and mechanical damage of chilli harvester at different combinations of operating parameters was shown in the Figure 1.

The harvesting cost of ripen chilli with harvester for 1pickings = Rs. 1635 per acre. As per the data collected from the various farmers of Guntur districts, the number of labour requirement for harvesting ripen chilli per acre was varied from variety to variety and yield of the crop. The average value was taken for the calculation purpose as followed. As per the data collected from the various farmers of Guntur district, the labour required for harvesting of ripen chilli was about 350 to 400 man. days/acr.

- i. The number of pickings required = 2 to 3
- ii. The expected yield = 30 to 40 quintals
- iii. The expected labour required = 350 to 400
- iv. The average wage of each person = Rs.250/-

The harvesting cost of ripen chilli with manual labour  
= No. of labour required  $\times$  Wage  
= 400  $\times$  250 Rs.

The harvesting cost of ripen chilli with manual labour  
= Rs.100000 per acre.

### CONCLUSION

The prototype ripen chilli harvester was fabricated with four numbers of adjusting gap between two rollers and four rotational speeds of double helical rollers. The pulleys were changed on the double helical roller to get the four numbers of speeds like 289 rpm, 393 rpm, 484 rpm and 658 rpm by kept one small size of pulley on prime mover. The four numbers of gaps were provided between the two rollers as 32 cm, 33 cm, 34 cm and 35 cm. The prototype ripen chilli harvester was run for three time at each combinations of rollers speed and gap between rollers. The harvesting efficiency of prototype ripen chilli harvester was calculated by comparing the ripen chilli pods per plant before and after harvested with chilli harvester.

The labour required for harvesting of ripen chilli varied from 350 to 400 man. day per acre. The approximate cost of labour for pickings per acre was Rs. 100000 and it is too expensive but mechanical harvesting was about Rs.1635 per acre.

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