

# SUCCESS STORIES...2013



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# **Root Crop Harvester for Onion, Garlic, Carrot and Potato Crops**

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## **Introduction**

Onion, garlic, carrot and potato are important vegetable crops which are cultivated in a wide variety of soil and weather conditions. The area under onion, garlic, root crops and potato in the state of Punjab was 8.14, 3.51, 16.04 and 83.12 thousand hectare with a production of 174.15, 38.44, 296.34 and 2116.52 thousand tonne, respectively in 2009-10. One of the main bottleneck in increasing the area under these crops is higher labour requirement for planting, inter-culture and harvesting operations. The large scale adoption of these crops will help in diversification which is only possible through mechanization. Potato diggers are available for digging potato crop and most of the other root crops are harvested/dug manually by some local tools like khurpa. To reduce the cost of cultivation of these crops, there is a need to develop a single machine that can harvest a variety of vegetable crops. The machine will go a long way in reducing the dependence on labor for harvesting different root crops viz. onion, carrot, garlic, potato and turmeric.

## **Salient Features of the Machine**

A root crop harvester was developed after modifying the existing potato digger and evaluated for mechanical digging of different crops like onion and garlic grown on single bed of 1.1 m width, and carrot and potato grown on ridges at 675 mm spacing. The machine consisted of a digger blade having width of 1144 mm and thickness of 16 mm. The blade was mounted on the machine at an angle of 20° with the horizontal. An elevator conveyor was attached behind the blade. The spacing between the MS rods of the elevator conveyor was 20 mm. The slope of the elevator conveyor was kept at 18°. Two oval agitators were provided in the conveying system for separation of soil particles from the tubers. The power to the elevator conveyor was provided through a gear box. Two coulter discs were provided in front of the blade at the outer ends which helped in easy slicing and lifting of soil by the blade. Extension at the rear was also provided to increase the time for separation of soil. Stationary view of the machine is shown in Fig. 4.1 and brief specifications of the machine are given in Table 4.1.



**Fig. 4.1. Stationary view of root crop harvester.**

**Table 4.1 Specifications of root crop harvester**

S. No.	Parameters	Specifications
1	Overall dimensions (L x W x H), mm	1500 x 1400 x 700
2	Power source	35 hp Tractor
3	Blade width x thickness, mm	1144 x 16
4	No. of coulters and diameter, mm	2, 500
5	Gear box speed ratio	5: 27
6	No. of agitators and lift, mm	2, 25
7	Type of conveyor	Chain conveyor made of M.S. rod of 9 mm diameter
8	Spacing between the conveyor rods, mm	20 mounted of rubber straps
9	Width and thickness of rubber strap, mm	60 x 6
10	Slope of conveyor, degree	18°

### **Evolution and Design Process**

A triangular blade of size 1730 x 60 mm was used for digging of onion by attaching two wheels for depth control. High draft was observed during operation as the full length of the blade was used to dig the tubers. Since the tubers were to be dug behind the tractor between the tyres, so it was decided to reduce the working width of the machine. The width of the machine was reduced from 1730 mm to 1430 mm.

The modified machine was evaluated for digging of Onion (Punjab Naroya) planted both under control traffic (on the beds having 1.1 m width) as well as on flat field sowing conditions during the year 2006. Performance of the machine was highly satisfactory for digging of the onion bulbs planted on single bed of about 1.1 m width. After the successful trials of the machine, a prototype of the machine was developed with an elevator conveyor attached behind the digging blade for cleaning, separation and easy collection of onion bulbs and a roller behind the conveyor was provided for soil compaction for easy collection of bulbs. During the year 2007, the machine developed for digging of onion was used for digging other crops like carrot and potato grown on ridges and garlic sown on beds under controlled traffic at Departmental Research Farm and at farmer's field. A view of the harvesting of onion, carrot, garlic and potato crops by root crop harvester is shown in Fig. 4.2.



(a)Garlic



(b)Onion



(c) Carrot



(d)Potato

**Fig. 4.2. Root Crop Harvester in operation for digging of garlic, onion and carrot and potato crop.**

## Performance of the Machine

The machine was evaluated in field for harvesting of onion, carrot, garlic, turmeric and potato crops during 2007-08 and 2008-09 and results are given in Table 4.2. The field capacity of the machine was 0.20, 0.26, 0.22 and 0.24 ha/h for digging onion, carrot, garlic and potato crops, respectively. Per cent exposed bulbs/roots were 99.0, 96.8, 98.6 and 96.4% for onion, carrot, garlic and potato crops, respectively whereas respective damage to the crop was less than 1.0, 2.8, 1.16 and 1.92%, respectively for the four crops. The performance of the machine was found satisfactory for digging these crops. The saving in cost of operation for harvesting onion, carrot and garlic was 54.74, 47.12 and 45.91%, respectively whereas saving in labour was 69.0, 59.2 and 61.41%, respectively as compared to manual harvesting and collection.

**Table 4.2 Performance results of Root Crop Harvester for onion, carrot, garlic and potato crops (2007-09)**

Parameters	Observations			
	Onion	Carrot	Garlic	Potato
Variety of crop	Punjab Naroya	PC - 34	Pb Garlic No.1	Kufri Pukhraj
Operational speed of the machine, km/h	2.10	2.74	2.0-2.5	2.41
Field capacity, ha/h	0.20	0.26	0.22	0.24
Effective digging width, mm	1000-1050	1050 - 1100	1000 - 1050	1000 – 1050
Exposed bulbs/roots, %	99.0	96.8	98.6	96.4
Cut bulbs/roots, %	<1.0	< 2.8	1.16	1.92
Fuel consumption, l/h	4.5-5.0	4.50-5.25	4.5-5.0	4.5-5.0
Labour requirement, man-h/ha				
a) For harvesting	5.0	4.0	4.34	4.13
b) For collection	150.0	200.0	150.0	220.0
c) Total	155.0	204.0	154.3	224.2
Saving in cost of operation, %	54.74	47.12	45.91	-
Saving in labour, %	69.00	59.20	61.41	-

## **Farmers Feedback**

The root crop harvester was demonstrated at farmer's fields of Gujarwal and Dhamot Kalan villages of Ludhiana district of Punjab in 4.0 and 0.5 ha area, respectively for digging of onion crop raised on bed in heavy soil. It was also demonstrated for digging of garlic crop raised on bed in an area of 20 ha of Gujarwal village of Ludhiana district. The digging performance of the harvester was very good (100% digging) and no damage to onion and garlic crop was observed. It was suggested to have an increase in length of conveyor belt to have more separation of soil. The harvester was also evaluated on 0.8 ha area in Baranhara village of Ludhiana district for digging of carrot raised on ridge. The digging performance was good with 96% digging and damage to tubers was 2-3% only. The farmers reported saving of more than 50% in cost of harvesting as compared to traditional method.

## **Status of the Technology**

The machine was also demonstrated to officials of the University and scientists from vegetable department and also at farmer's field during 2009-10. The root crop harvester was approved under package of practices of PAU, Ludhiana as vegetable digger in the proceedings of 228<sup>th</sup> meeting of Research Evaluation Committee. Four machines were supplied to different cooperating centers of AICRP on Farm Implements and Machinery after multiplying the machine from local manufacturer for prototype feasibility testing and frontline demonstrations (Annexure IV). The machine is commercially available from M/s Droli Industries (Basant), Moga, Punjab.

## **Manufacturers address**

M/s Droli Industries  
Near Dhaliwal Hospital  
Majestic Road, Moga - 142001 (Punjab)  
Tel: +91-1636-223557, 91-9814029811  
E-mail: basant\_droli@yahoo.com; basant\_droliind@yahoo.co.in

## Annexure IV

### Supply of root crop harvester to centres of AICRP on FIM for prototype feasibility testing

<b>S. No.</b>	<b>Name of the Centres</b>
1.	Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra (MPKV)
2.	Tamil Nadu Agricultural University, Coimbatore, T.N. (TNAU)
3.	Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan (MPUAT)
4.	Acharya NG Ranga Agricultural University, Hyderabad, A.P. (ANGRAU)