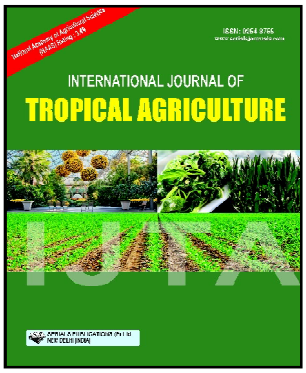

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Efforts Towards Development of Harvesting Equipments for Mango in Konkan

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Abstract: Mango is the most important fruit accounting for 37.60 % of area (1.3 million hectares) and contribute 22.21% of total fruit production (14.0 million metric tons) in India. Konkan of Maharashtra state is well known for Alphonso mango and the area under mango is increased to 0.181 million hectares. Harvesting stage is more crucial and mango harvested along with pedicel, increases keeping quality of mango. In order to meet the requirement, the efforts have been made by Dr. B.S. Konkan Krishi Vidyapeeth and the university has developed equipments for small and large mango growers for harvesting. The efforts stared with development of Nutan mango harvester (pucker). Later on it was modified and name is given as Naveen mango harvester by reducing its size. The multi fruit harvester has also been developed for mango, kokum and cashew harvesting. These are to be used by attaching stick or pipe and operated manually. A tractor operated elevator for harvesting, spraying has been also developed during 2010-11. The higher plant height restricts the use of plucker for harvesting. The tractor operated elevator developed by this university has platform to stand operator and keep the fruits in basket, and able to rotate platform to left and right side of tractor to 180°. One of the version is suitable upto 12 m and other version is suitable upto 14 m plant height. It is found that these equipment have potential to tackle the need for mechanization improvement status.

Key words: Mango, plucker, fruit harvester, elevator

The total production of fruits and vegetable in the world is around 370 M.T. India ranks first in the world with annual production of 32 M.T. Andhra, Telangana, Bihar, Gujrat, Kerala Madhya Pradesh and Maharashtra, Tamil Nadu are major fruit growing states in India. Mango is the most important fruit

accounting for 37.60 % of area (1.3 million hectares) and contribute 22.21% of total fruit production (14.0 million metric tons) in India. Most mango fruits, large or small, soft or hard skinned, can be picked with Fruit Plucker. The Twister type and pull types comes with everything one needs to be picking fruit in minutes. One needs a pole to attach the plucker. The pole one chooses depends on the height of the tree one will be picking. Mostly bamboo stick or a GI pipe (pole) is used by the people. For the most versatility an aluminum light weight extension pole is better.

The Konkan is hilly terrain and occupied between Arabian sea and Western ghat/hills range. It is a coastal belt of Maharashtra and rice based as well as horticultural based cropping system is followed. The socio economic status of farmer is poor. The mechanization status in agriculture is very low as compared to other part of Maharashtra state. Konkan of Maharashtra state is well known for Alphanso mango and the area under mango is increased to 0.181 million hectares. Harvesting stage is more crucial and mango harvested along with pedicel, increases keeping quality of mango.

In order to reduce the drudgery involved in farm operation, and to improve the mechanization status of Konkan region, the efforts have been made by Dr. B.S. Konkan Krishi Vidyapeeth and the university has developed equipments for small and large mango growers for harvesting. The efforts stared with development of Nutan mango harvester (pucker). Later on it was modified and name is given as Naveen mango harvester by reducing its size. The multifruit harvester has also been developed for mango, kokum and cashew harvesting. These are to be used by attaching stick or pipe and operated manually. A tractor operated elevator for harvesting, spraying has been also developed during 2010-11. The higher plant height restricts the use of plucker for harvesting. The tractor operated elevator developed by this university has platform to stand operator and keep the fruits in basket, and able to rotate platform to left and right side of tractor to 180°. One of the version is suitable upto 12 m and other version is suitable upto 14 m plant height. It is found that these equipment have potential to tackle the need for mechanization improvement status.

TECHNIQUES OF MANGO HARVESTING

Worldwide in underdeveloped and developing countries, the manual harvesting of mango with picker or plucker is very commonly adopted technique. Another technique is Use of Elevators. These are Self Propelled, Tractor Operated Hoist, Ladder, and Platforms etc. There are automatic machines also used in developed countries. In initial days, the Konkan Krishi Vidyapeeth developed Nutan Mango harvester and later Naveen Mango harvester.

NUTAN AND NAVEEN MANGO HARVESTER

Both the harvesters consist of ring, handle pipe, V blade, circular cutter and nylon mesh. Both are very popular among farmers. The Dr BSKKV has sold more than 30,000 pieces to the farmers though the production and sales division. The design dimensions of both the harvesters are as shown in Table 1. The dimensions details of the same are as given in Fig 1.

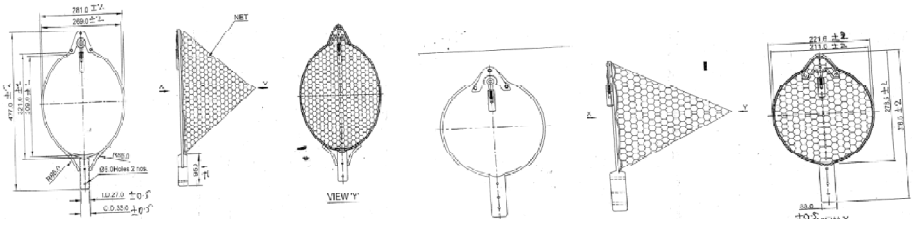

Figure 1: Dimensions details of Nutan and Naveen Mango harvester

The construction point of view there is no difference in to harvesters. The weight of Nutan harvester is 480 g while weight of Naveen harvester is 290 g. The light weight of new version reduces drudgery in harvesting. The capacity of the harvester is in the range of 120-160 mango/hr. The Fig 2 and 3 shows the view of these two harvesters.

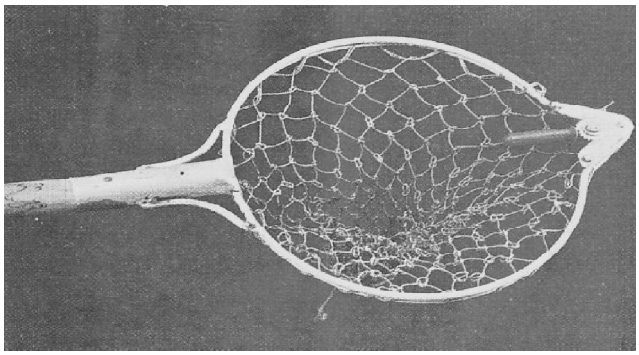

Figure 2: Nutan Harvester

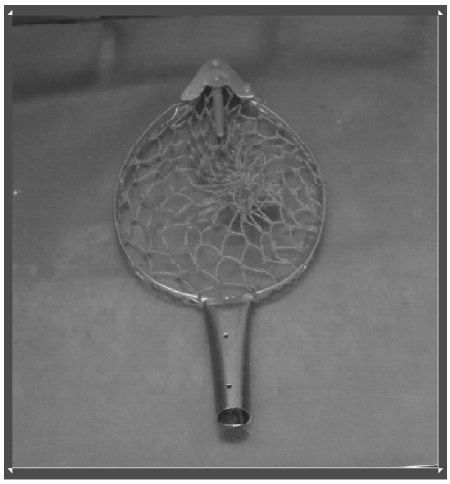

Figure 3: Naveen Harvester

Table 1
The components and material of Nutan and Naveen mango harvester

S.N.	*Nutan Mango Harvester*		*Naveen Mango Harvester*	
	Part Description	*Material*	*Part Description*	*Material*
1	Ring	M.S.	Ring	M.S.
2	Handle Pipe	M.S.	Handle Pipe	M.S.
3	V Blade	M.S. Plated	V Blade	M.S. Plated
4	Circular Cutter	M.S. Plated	Circular Cutter	M.S. Plated
5	Divider	Plastic	Divider	Plastic
6	Nylon Net	Nylon	Nylon Net	Nylon

MULTI FRUIT HARVESTER

The erect position of pole and plucker sometimes results into falling of fruits from plucker. This is due to the higher inclination of ring with horizontal surface. To reduce falling of mango from net the provision is made to adjust the angle of pole and plane of ring in new version of fruit plucker i.e. multi fruit harvester. At lower height the long pole increase drudgery hence the provision is made to have a adjustment in length of pole. This improved the performance of harvester. The multi fruit harvester is shown and length adjustment is shown in Fig 4 and 5.The comparison of Multi fruit harvester with Nutan harvester is as sown in Table 2.

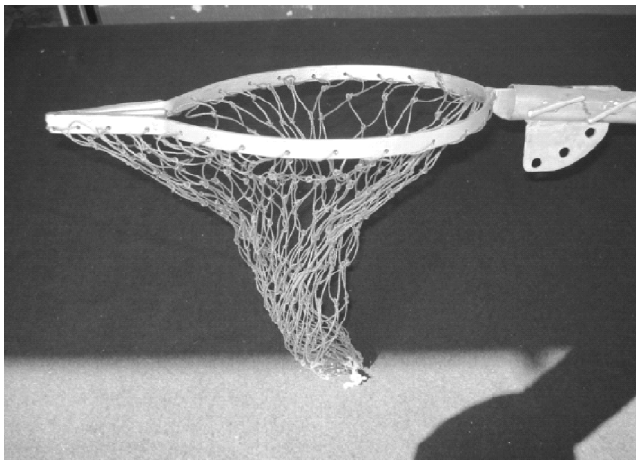

Figure 4: Multifruit Harvester

Figure 5: Pole Length adjustment

Table 2
The comparison of Multi fruit harvester and Nutan Harvester

Sr. No.	*Parameters*	*Multi Fruit Harvester*	*Nutan Harvester*
1	Weight, g	320	480
2	Ring size		
	1. Major axis, mm	220	310
	2. Minor axis, mm	170	280
3	Blade length, mm	50	30
4	Blade angle, degrees	58	62
5	Provision of telescopic handle	Yes	No
6	Provision of angle adjustment	Yes	No
7	Provision for blade replacement	Yes	No

PERFORMANCE OF MULTI FRUIT HARVESTER

The performance of multi fruit harvester was tested for different fruits i.e. cashew, mango and kokum. The Table 3 shows that the capacity of harvester for cashew, mango and Kokam was found to be 3104, 1336 and 1600 fruits/day. The fruit drop from the harvester was quite less.

Table 3
Performance of Multi fruit Harvester for different fruits

Sr. No.	*Particulars*	*Cashew*		*Mango*		*Kokum*	
		Multi fruit harvester	*Manual shaking*	*Multi fruit harvester*	*Nutan*	*Multi fruit harvester*	*Manual shaking*
1	No. of Fruits harvested/person/day	3104	5160	1336	1040	1600	480
2	No. of fruits dropped during harvesting /day	59	5160	1	17	58	480
3	Percentage of fruits dropped during harvesting /day	1.86	100	1.25	0.0096	3.46	100
4	Percentage of fruits damaged/day	Nil	100	Nil	Nil	Nil	100
5	Weight of fruits harvested, kg/day	141.01	234.45	333	260	40.06	12

TRACTOR MOUNTED HYDRAULIC ELEVATOR

After developing the manually operated fruits harvesters, the efforts were also made by Dr BSKKV Dapoli for tractor operated fruit harvester. It is a sort of elevator. It consist of a platform, linkage, hydraulic motor, turntable and hydraulic pipes. The person is able to stand on the cage/platform. The hydraulic control valves for lifting, lowering and rotating the platform to clockwise and anticlockwise to 180° are provided on cage. The person standing himself has to operate the valves. The harvesting tool is to be operated by the person standing. The system is safe and more comfortable. In the wide spaced fruit crop i.e. mango, coconut etc this elevator can cover four tress from one static position of tractor. The power source of tractor is 35 HP. The components details are as shown in Table 4. First version of this machine is suitable for trees upto 12 m height while other version upto 14 m height.

Table 4
Details of components of tractor mounted hydraulic elevator

S.N.	*Components*	*Specifications*
1.	Special purpose hydraulic pump	15 liter per minute oil flow, vane type
2.	Hydraulic motor	3 HP, High torque low speed hydraulic motor
3.	Multi position multi way direction control valve	Eight-inlet port and eight-output port with attachment of control lever.
4.	Hydraulic cylinder	Cr -V coated
5.	Turn table	High torque low speed hydraulic motor coupled to a reduction gearbox.
6.	Upper link and lower link	5 m and 4.5 m length respectively
7.	Harvesting bucket	Cage size: 1.0 x 0.7 x 1.0 meters. Capacity :200 Kg
8.	Hose pipes	HDPE hard coated
9	Pulleys, belt and accessories.	V groove pulley A-type belt.
10	Supporting wheel	Hardened steel
11	Prime Mover	Tractor: Mahindra B-275

Fig 6-7 shows the developed tractor mounted elevator and its platform/cage.

Figure 6: Tractor Mounted Hydraulic Elevator

Figure 7: The platform of Elevator

The performance of elevator was tested for mango crop on University field. The machine was tested for harvesting of mango trees of different heights. It was seen that lifting time was found to be more as compared to lowering for all the tested heights in the range of 7-13m. The table indicated that the total time for trees of different heights i.e. 7-9, 9-10, 10-11, 11-12 and 12-13 m required total time of operation of 82.5, 108.8, 126.6, 138 and 145 sec respectively. This machine found useful for other operation like spraying with knapsack sprayer, tree pruning or cleaning operation of leafs, branches etc. In a straight forward direction the machine could able to work upto slope of 4.5 %. On higher slope the tractor direction needed to be reversed.

Table 5
Performance testing of Tractor Mounted Hydraulic Elevator for Mango tree

Sr. No.	*Tree Height, m*		*Required time, sec*			
			Lifting	*Lowering*	*Harvesting*	*Total time, sec*
1	**7-9**	7.50	15	11	50	76
		8.75	22	12	55	89
	Av.	**8.12**	**18.5**	**11.5**	**52.5**	**82.5**
2.	9-10	9.50	27	21	50	98
		9.60	31	19	60	110
		9.70	28	22	60	110
		9.80	32	20	61	113
		9.90	31	22	60	113
	Av	**9.7**	**29.8**	**20.8**	**58.2**	**108.8**
3	10-11	10.00	37	22	61	120
		10.30	35	25	65	125
		10.40	40	25	58	123
		10.60	46	27	65	138
		10.90	36	26	65	127
	Av	**10.44**	**38.8**	**25**	**62.8**	**126.6**
4	11-12	11.10	40	29	68	137
		11.70	42	30	67	139
	Av	**11.40**	**41.00**	**29.50**	**67.50**	**138**
5	12-13	12.30	45	30	70	145
		12.40	46	31	68	145
	Av	**12.35**	**45.50**	**30.50**	**69**	**145**

The Table 6 shows the Dr BSKKV elevator is more versatile as compared to elevators developed by Tamil Nadu Agril Unversity, Coimbtore, Anand Agril. University, Anand.

S.N	*Particular*	*AAU elevator*	*TNAU Elevator*	*DBSKKV elevator*
1	Harvesting, pruning, and spraying operation	Manually	Manual	Manual
2	Lifting mechanism	Semi automatic	Semi automatic	Automatic
3	Movement of machine	Vertical with inclined platform	In vertical plane	180^0 on each side
4	Machine mounting source	Tractor trolley	Ground with three point linkage	Tractor three point linkage
5	Number of trees covered from one location	One	One	Four
6	Maximum lifting height	7.5 m	9.5 m	10.00 m

CONCLUSIONS

1. The equipments developed by Dr BSKKV have been found more useful and suitable in Konkan region.
2. They have potential in Konkan region for improving the mechanization status in the region

REFERENCES

Anonymous 2016[1]. Area Production and yield of principal crops. Pocket book of Agricultural Statistics 2016. *http:// eands.dacnet.nic.in/PDF/Pocket-Book.*

Anonymous[2]. 2016. Final estimates of area, production & productivity of principal crops during 2014-15 in M.S. *http://www.mahaagri.gov.in*

Anonymous, 1997. Research Highlights, 1972-1997. Directorate of Research, Dr BSKKV Dapoli M.S.: pp 14-15.

Anonymous, 2010. Development and Performance Evaluation of Multi fruit Harvester. Report of Recommendation Release Committee, Deptt. FMP, Dr BSKKV Dapoli, M.S:pp 1-8.

Anonymous, 2012. Research Review Committee Meeting Report, Faculty of Agril. Engg. Dr BSKKV Dapoli, M.S:pp 10-28.