



Development and Evaluation of Hand Operated Apple Peeler

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The aim of the present study was to develop and evaluate a low cost, small scale hand operated apple peeler. A low-cost durable hand operated apple peeler having overall dimensions of 305 mm × 225 mm × 30 mm was fabricated. The performance of the developed prototype was evaluated for different parameters in comparison to manual peeling (using knives). Significantly ($p < 0.05$) high peeling capacity (42 kg/hour), high percentage of peel removal (17.92) and high depth of cut (0.95 mm) were recorded for developed hand operated apple peeler in comparison to manual peeling (i.e., knives). In contrast, significantly ($p < 0.05$) lower peeling efficiency of 84% and labor requirement of 23.80 man hr/ton were recorded in case of hand operated apple peeler whereas in case of manual peeling it was recorded as 100% and 51.28 man hr/ton respectively.

Keywords: Labour requirement, Low cost, Manual peeling, Peeling capacity, Peeling efficiency

Introduction

Jammu and Kashmir state accounts for more than 70 percent of the total apple production in India.¹ In J&K, the total area under apple cultivation is 162 971 hectares with an annual production of 17 26 834 MT.² Conventional practice of apple peeling in the state is manual peeling using knives or hand held peelers which are not restricted to apples only. The use of hand operated apple peelers can help to stand out fresh cut apples as novel convenient food by merging the technical content with innovative food concept.

Materials and Methods

Hand operated apple peeler was developed by Srinagar Centre of All India Coordinated Research Project on Post-Harvest Engineering and Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, India during the year 2018–2019.

Working Operation

The apples are inserted into the 3-frong fork (Fig. 1) where the basic rotatory mechanism of threaded rod initiated by cranking rod spins the apples with a lower torque. The peeling blade then peels the apples as they move through the rod steadily in a forward direction.

Performance Evaluation of Hand Operated Peeler

Hundred kg of apples (var. Red Delicious) were procured from research center of SKUAST-K, Shalimar and were tested for parameters like peeling capacity, peeling efficiency, peel removed, depth of cut and labor requirement using both developed hand operated apple peeler and kitchen knives.

$$\text{Peeling capacity (kg/hr)} = \frac{\text{Weight of peel removed (Kg)}}{\text{Time taken /person/ hr}} \times 100$$

$$\text{Peeling efficiency (\%)} = \frac{\text{Peeled surface area of the apples}}{\text{Total surface area of the apples}} \times 100$$

$$\text{Peel removal (\%)} = \frac{\text{Weight of peel removed (Kg)}}{\text{Total weight of unpeeled apples (Kg)}} \times 100$$

Depth of cut (mm) was calculated as the thickness of the peel removed using vernier caliper having 0.001 mm accuracy

$$\text{Labor requirement} \left(\frac{\text{man hr}}{\text{ton}} \right) = \frac{1}{\text{Peeling capacity (Kg/hr)}} \times 1000$$

Statistical Analysis

Experiments were performed in triplicates and mean values were calculated. In order to compare the performance of developed hand operated apple peeler

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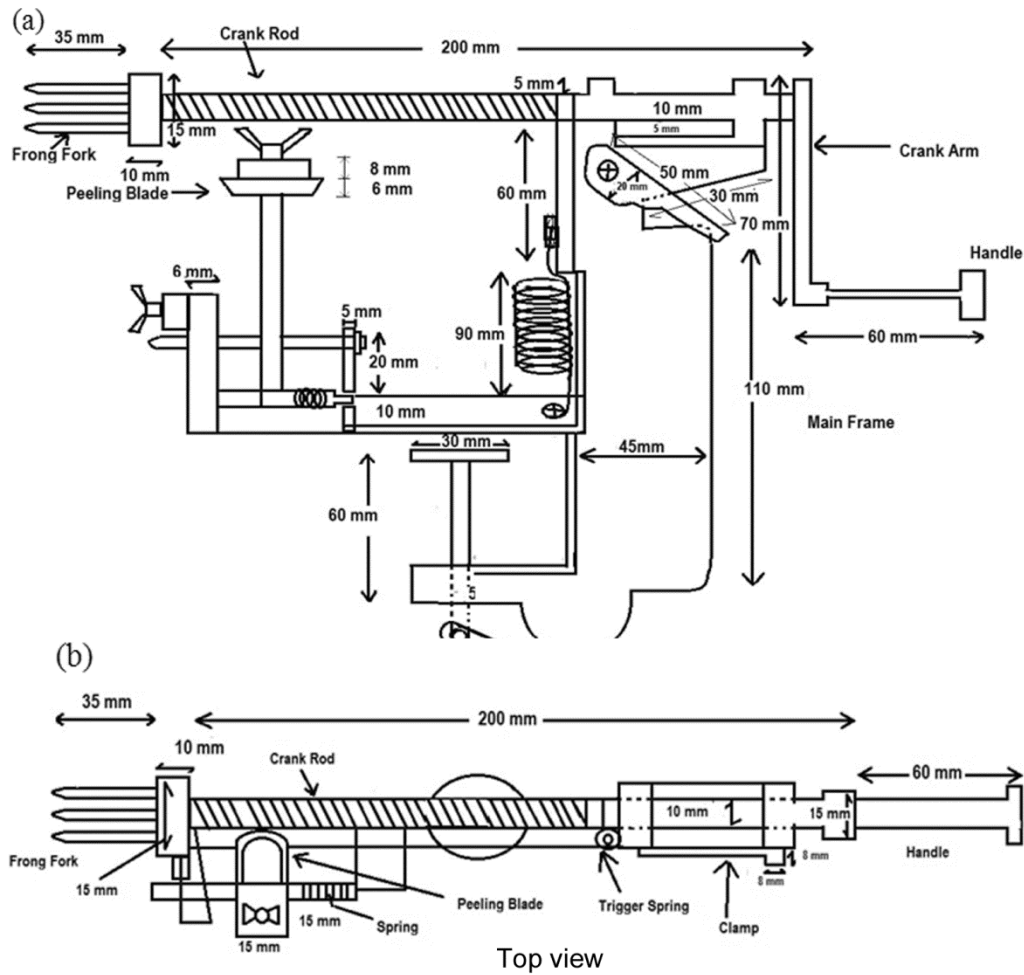


Fig. 1— Schematic views of hand operated apple peeler (a) Front view of hand operated apple peeler; (b) Top view of hand operated apple peeler

Table 1 — Material of construction used in different parts of hand operated apple peeler

S. No.	Component of Machine	Material Used	Purpose of material selection
1	Main Frame	Casted Aluminum Alloy	Outstanding corrosion resistance, light weight, higher strength and hardness
2	Crank Rod	Stainless Steel	Higher Corrosion resistance, toughness, strength, attractive appearance
3	3-Fronged Fork	Stainless Steel	Higher Corrosion resistance, toughness, strength, attractive appearance
4	Peeling knife	Stainless Steel	Higher Corrosion resistance, toughness, strength, attractive appearance
5	Crank Arm	Casted Aluminum Alloy	Outstanding corrosion resistance, light weight, higher strength and hardness
6	Lead Screw	Stainless Steel	Higher Corrosion resistance, toughness, strength, attractive appearance
7	Trigger Spring	High carbon spring steel	High tensile strength and ductility

with manual peeling (using knives), students t-test was employed at 5% level of significance.

Results and Discussion

Design and Development of Hand Operated Apple Peeler

A portable hand operated apple peeler having overall dimensions of 305 mm × 225 mm × 30 mm was fabricated and evaluated. The weight of the

developed prototype is 600 gm. The different schematic views of hand operated apple peeler are given in Fig. 1. Material of construction and brief specifications are given in Tables 1 and 2.

Material of Construction and Dimensions of Different Components

Main frame (245 mm × 225 mm × 15 mm) and crank arm (70 mm × 10 mm) were made of casted

Table 2 — Brief Specification of hand operated apple Peeler

S. No.	Parameters	Specification
1	Overall dimension	Length = 305 mm; Breadth = 225 mm; Thickness = 30 mm
2	Main Frame	Length = 245 mm; Breadth = 225 mm; Thickness = 15 mm
3	Crank Rod	Diameter = 10 mm; Length = 200 mm
4	3-Fronged Fork	Diameter = 15 mm; Length = 35 mm
5	Crank Arm	Length = 70 mm; Breadth = 10 mm
6	Lead Screw	Diameter = 5 mm; Length = 60 mm

Table 3 — Comparative evaluation of hand operated apple peeler and manual peeling

Parameters	Hand operated apple peeler	Manual peeling using knives	t-value
Peeling capacity (Kg/hr)	42± 0.15	19.5± 0.2	38.52*
Peeling efficiency (%)	84±0.5	100±0.3	30.17*
Peel removal (%)	17.92±0.43	12.94±0.31	10.17*
Depth of cut (mm)	0.95±0.6	0.40±0.3	29.96*
Labor requirement (man hr/ton)	23.80±0.65	51.28±0.8	54.79*

* Significant calculated t-value at P<(0.01)

aluminum alloy owing to its high strength, rigidity, corrosion resistance and light weight. Crank rod of diameter 10 mm and length 200 mm, 3-fronged fork (diameter = 15 mm and length = 35 mm), peeling knife and lead screw (dia = 5 mm and length =60 mm) were fabricated out of stainless steel. Trigger spring was made of high carbon spring steel to provide high tensile strength and ductility.

Performance Evaluation of Hand Operated Apple Peeler

Comparative evaluation of hand operated apple peeler and manual peeling (using knives) is presented in Table 3. Peeling capacity of hand operated peeler (42 kg/hour) was found to be significantly (p<0.05) higher than that of capacity (19.5 kg/hr) recorded for manual method of peeling (i.e., knives). Developed hand operated apple peeler showed significantly (p<0.05) lower peeling efficiency of 84% whereas 100% peeling efficiency was recorded in manual peeling (using knives). High peel removal percentage (17.92) was recorded for hand operated apple peeler compared to 12.94 in manual peeling method. Depth of cut recorded for hand operated apple peeler was 0.95 mm whereas a significantly (p<0.05) lower depth of cut (0.40 mm) was obtained in manual method of peeling. Labor requirement for peeling one ton of apples using developed prototype was recorded to be 23.80 man hours which was significantly (p<0.05) lower than the labor requirement of 51.28 man-hour

recorded in case of manual peeling (using knives). Krishnan and Ganesh³ reported development of lathe type apple peeler with a blade adjustment/ positioning device. However, the authors have not evaluated the prototype for performance evaluation like efficiency, peeling capacity, labor requirement etc.

Conclusions

Development of hand operated apple peeler presents a scientific intervention which can overcome the drudgery and boredom involved in manual peeling (using knives). Besides reducing the labor costs with enhanced capacity, the use of developed prototype will ease out the apple peeling operation as compared to manual peeling (using knives). The peeling capacity, peel removal percentage and depth of cut were recorded higher in case of hand operated apple peeler, whereas peeling efficiency and labor requirement were recorded higher in manual method of peeling.

References

- 1 Islam T R & Shrivastava S. A Study on Area, Production & Productivity of Apples in J&K from 2006-07 to 2015-16, *Int J Scientific Res Mgmt*, **5(7)** (2017) 6513–6519.
- 2 Singh R, Mishra S, Sheikh S A. A Study About Area & Production of Apple in Jammu & Kashmir, *Int J Res Agric Food Sci*, **3(4)** (2017) 1–10.
- 3 Krishnan R N & Ganesh S. Design & Fabrication of Apple Peeler/SlicerGreen Engineering, *Int J Innov Sci Res Technol*, **2(5)** (2017) 723–727.