DEVELOPMENT OF A SIMPLE TECHNIQUE FOR WATERMELON SEED EXTRACTION

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PROJECT REPORT

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KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY

TAVANUR - 679 573, MALAPPURAM

KERALA, INDIA

1999

DECLARATION

We hereby declare that this project report entitled **"Development of a Simple Technique for Watermelon Seed Extraction"** is a *bonafide* record of the project work done by us during the course of project and that this report has not previously formed the basis for the award to us of any of degree, diploma, associateship, fellowship or other similar titles of any other University or Society.

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9th April, 1999

CERTIFICATE

Certified that this project report entitled **"Development of a Simple Technique for Watermelon Seed Extraction"** is a record of project work done jointly by Mr. Dhalin, D., Miss. Jayalekshmi, K. and Mr. Rakesh, K.N. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to them.

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SYMBOLS AND ABBREVIATIONS USED

cm	-	centimeter
G.I.	-	galvanized iron
et al.	-	and others
Fig.	-	figure
mg	-	milligram
g	-	gram
ha	-	hectare
hp	-	horsepower
h	-	hour
kW	-	kilowatt
m	-	metre
mm	-	millimetre
M.S.	-	mild steel
kg	-	kilogram
P.A.U.	-	Punjab Agricultural University
rpm	-	revolution per minute
Rs.	-	Rupees
&	-	and
viz.	-	namely
Wt.	-	weight
I.U.	-	International Unit
%	-	percentage
FPME	-	Farm, Power, Machinery, and Energy
SAC	-	Supportive and Allied Courses of Study
KCAET	-	Kelappaji College of Agricultural Engineering and Technology

INTRODUCTION

India is in the process of becoming one among the major industrial nations of the world, in the near future. Concurrently, the agro-food industry is also making rapid strides along the length and width of the country. This fast expansion of agro-food industry is partly because of the self sufficiency in food grain and the increased production of fruits and vegetables. However, it is necessary that the vegetable and fruit production is increased manifold for meeting the needs of the entire population. Among the vegetables, an important commodity is the watermelon, belonging to the gourd family. Watermelon is a succulant fruit and is much sought after during the summer season.

A notable characteristic of this fruit is the presence of numerous flat seeds in the flesh. These seeds have to be separated and removed for seed purpose and also while being prepared for a drink. Presence of the seed in large number in the drink is often distracting and irritating.

The success of any crop production programme depends partially upon the *quality* of seed, since it is the basic input and a major deciding factor. The quality is assessed based on the seed health, germination percentage, vigour, purity, intactness of seed, dormancy period,etc. The intactness of seed depends mainly upon the method of seed extraction. The extraction of seed can be by manual

method or by mechanical method. In India, manual seed extraction is more in practice. But it is quite cumbersome, expensive, unhygienic and monotonous.

On the other hand, mechanical seed extraction, in many situations, reduces the cost of seed production, enhances the rate of seed extraction, and reduces or eliminates the hazards caused to the labourers during the seed extraction. Many attempts are seen made in this field wherein the flesh is mashed and seeds are extracted. But, a seed extraction in which the flesh is not mashed is more advantageous, particularly in the preparation of fresh watermelon beverage. So far, a simple technique was not available for the seed extraction from watermelon.

Keeping all these in view a project was undertaken at the Kelappaji College of Agricultural Engineering and Technology, Tavanur with the following objectives.

1. To develop a simple technique for extracting separately the flesh and the seeds of watermelon.

2. To evaluate the merits and demerits of the technique.

REVIEW OF LITERATURE

A brief review of the general characteristics of watermelon and the traditional and mechanical methods of seed extraction are presented in this chapter.

Watermelon (*Citrullus vulgaris*) belongs to the family cucurbitaceae. The fruit is a pepo formed from multilocular inferior ovary with numerous flattened seeds in each locule attached to the parietal placenta. The mesocrap contains a pink, red, or yellowish white flesh with watery juice. Endocarp is membraneous, and closely developed.

In Kerala, it is an important fruit grown in the river beds and garden lands of Cannannore and Malappuram districts. The important varieties are Sugar Baby and Arka Jyoti. It is usually grown in the months, December to June. December to February is the best season for sowing. The crop can survive the desert climate when ground water is not available.

Its small fruits are used for making pickles. Roasted seeds are popular in China and Africa. The seed contains an extractable quantity of semi-drying oil. When the fruit is used for preparing a drink, it becomes advantageous if its

numerous seeds are separated and removed. Seeds are to be removed for seed purpose as well. Some of the methods of seed extraction seen reported in the literature are presented in the following sections.

2.1 Traditional Methods of Seed Extraction

Traditionally the seed extraction is carried out mostly by manual labour. For vegetable crops using wet seed extraction, the principle of floatation which makesuse of differential specific gravity of seed and pulp is utilised for the separation of seeds.

In the case of watermelon, the fruits for seed purpose are cut into pieces with the help of knife. The seeds are scooped out with hand fingers and placed in a water container to separate the seeds from the seed pulp and other miscellaneous materials.

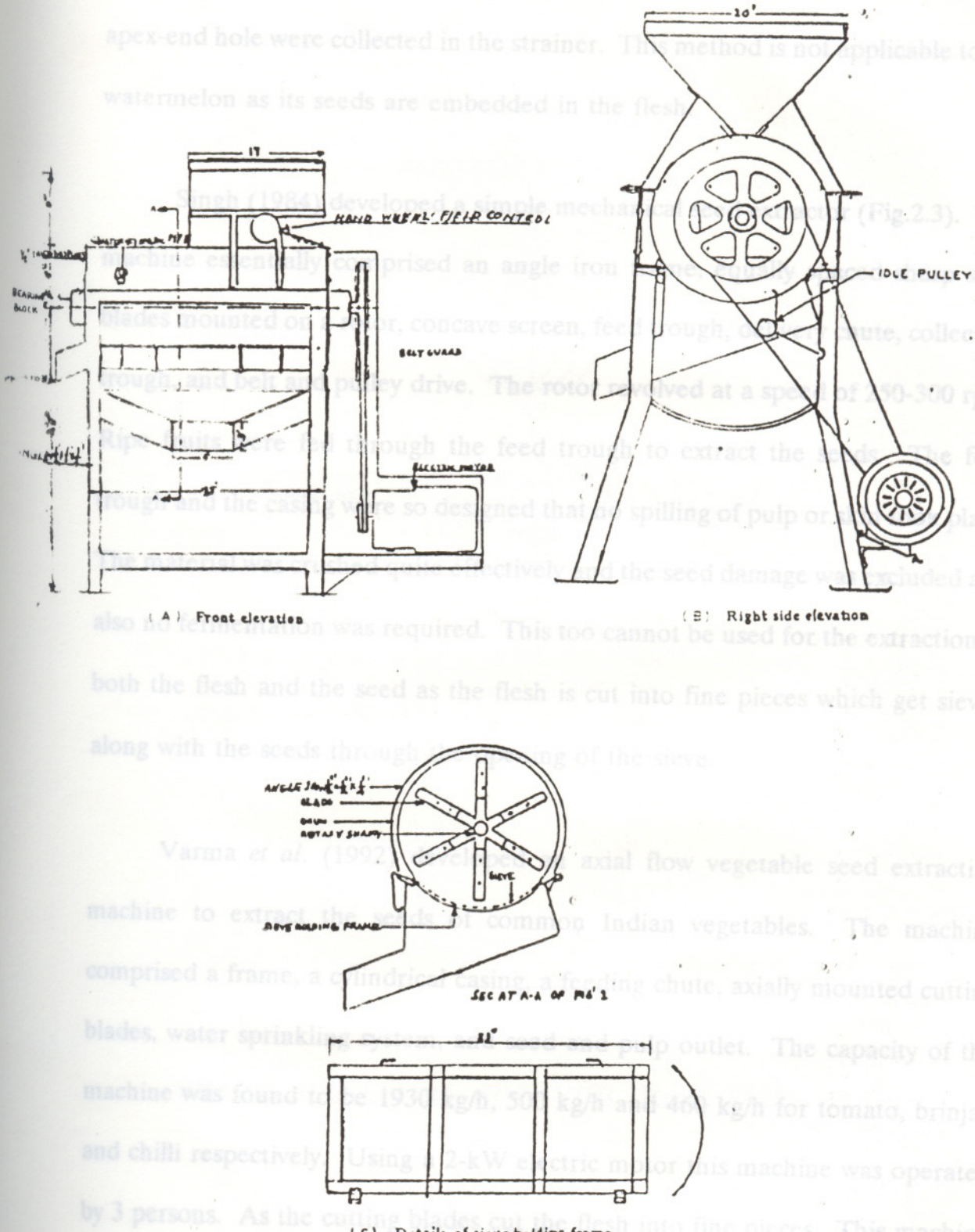
2.2 Mechanical Methods of Seed Extraction

There is not much published work in the literature regarding the use of machines or mechanical devices for the extraction of watermelon seeds. The review was, therefore, extended to the mechanical methods adopted in the case of the similar type of seeds.

Nicholas (1971) designed and developed a machine for vegetable seed extraction (Fig.2.1). It consisted of a horizontal drum made of G.I. sheet strengthened with angle iron rings at the end. Inside the drum was a rotary shaft with beaters arranged spirally on the shaft. Each beater had a bent M.S. flat holder welded to the shaft. To this holder was bolted a replaceable blunt knife. A holding frame was fitted at the bottom section of the drum to allow fitting of different screens. Two outlets were provided to the drum, one at the bottom to collect the extracted, screened out seeds and juice, and the second at the rear end to discharge the pulp. The machine was fitted with an electric motor to drive the rotary shaft. For the extraction of brinjal, tomato and watermelon, water was required. In this method, the flesh was completely mashed into a paste which is not desirable in certain cases.

Fisher and Widmoyer (1977) made a seed extractor from the drum, motor and pulley system of a front loading washing machine mounted on a plywood covered frame.

Reed (1981) developed a pressure spray system which eliminited the fermentation process for cleaning the muskmelon seeds (Fig.2.2). A hole of 3 cm diameter was made both at the stem end and apex end of the fruit. The fruit was held over a kitchen strainer. Water from the tap was fed into the stem-end hole and poured into the seed cavity. Seeds flushing out of the fruit through the



(A) Front elevation

(B) Right side elevation

(C) Details of sieve holding frame

FIG.2.1 VEGETABLE SEED EXTRACTOR (Nicholas, 1971)

apex-end hole were collected in the strainer. This method is not applicable to the watermelon as its seeds are embedded in the flesh.

Singh (1984) developed a simple mechanical seed extractor (Fig.2.3). The machine essentially comprised an angle iron frame, equally spaced sharp steel blades mounted on a rotor, concave screen, feed trough, delivery chute, collecting trough, and belt and pulley drive. The rotor revolved at a speed of 250-300 rpm. Ripe fruits were fed through the feed trough to extract the seeds. The feed trough and the casing were so designed that no spilling of pulp or skin took place. The material was crushed quite effectively and the seed damage was excluded and also no fermentation was required. This too cannot be used for the extraction of both the flesh and the seed as the flesh is cut into fine pieces which get sieved along with the seeds through the opening of the sieve.

Varma *et al.* (1992) developed an axial flow vegetable seed extracting machine to extract the seeds of common Indian vegetables. The machine comprised a frame, a cylindrical casing, a feeding chute, axially mounted cutting blades, water sprinkling system, and seed and pulp outlet. The capacity of the machine was found to be 1930 kg/h, 500 kg/h and 460 kg/h for tomato, brinjal, and chilli respectively. Using a 2-kW electric motor this machine was operated by 3 persons. As the cutting blades cut the flesh into fine pieces. This machine also cannot be used for the watermelon.

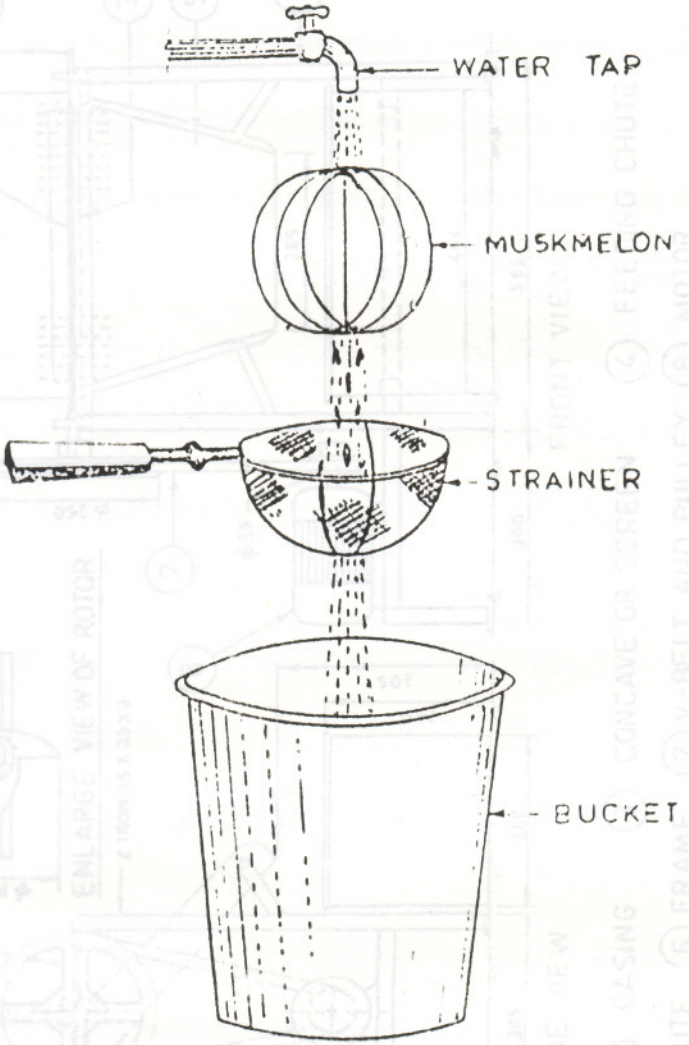


FIG.2.2 PRESSURE SPRAYER (Reed, 1981)

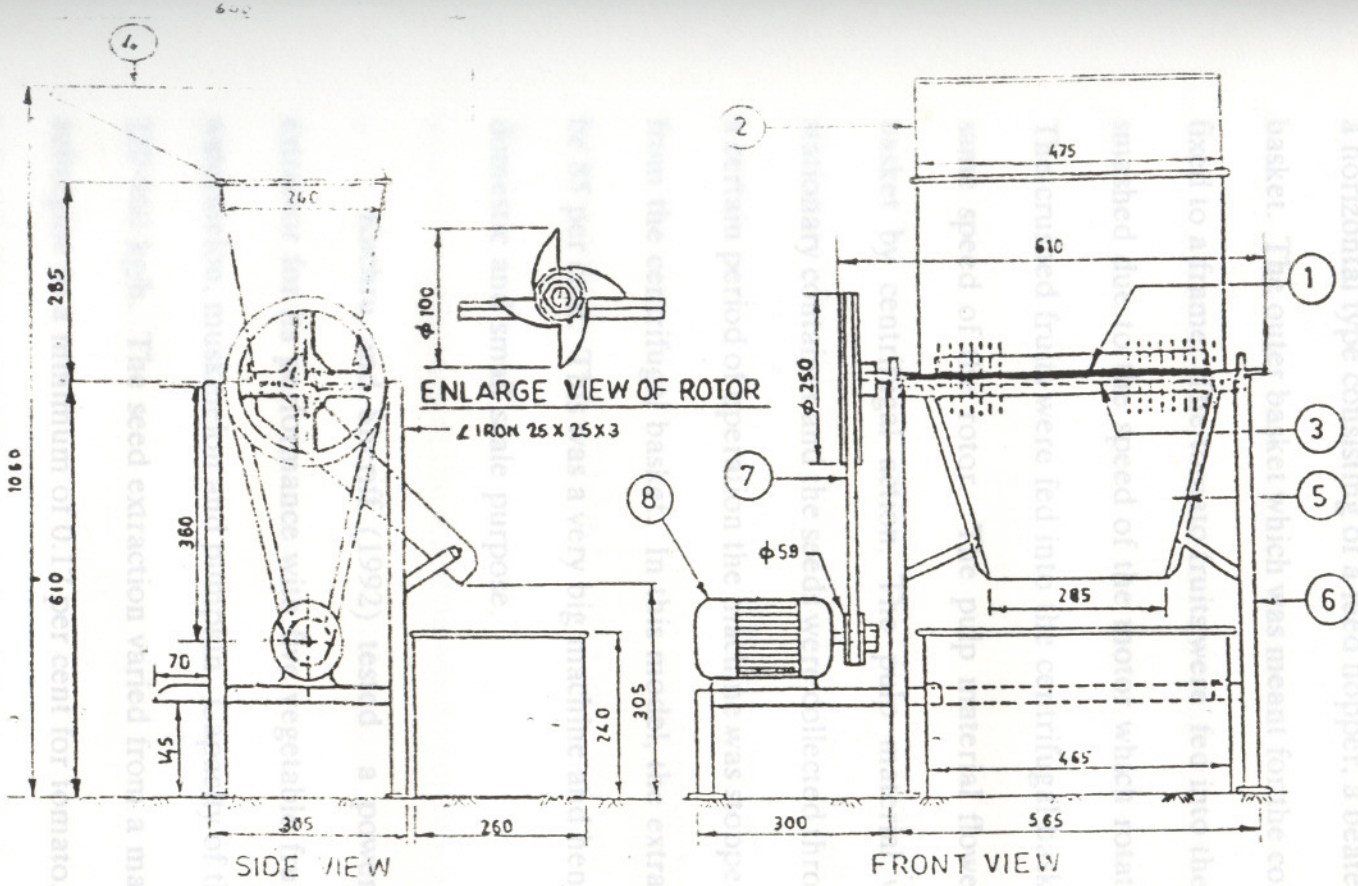


FIG.2.3 SIMPLE VEGETABLE SEED EXTRACTING MACHINE (PAU, 1984)

Devadas *et al.* (1993) developed a tomato seed extractor. The machine was a horizontal type consisting of a feed hopper, a beater assembly and a centrifugal basket. The outer basket which was meant for the collection of pulp material was fixed to a frame. The tomato fruits were fed into the cylinder and beaten up and smashed due to the speed of the motor which rotated at a speed of 1440 rpm. The crushed fruits were fed into the centrifugal basket which also rotated at the same speed of the rotor. The pulp material flowed through the sieve of the basket by centrifugal action. The pulp material was collected in the outer stationary container and the seeds were collected through a separate outlet. After a certain period of operation the machine was stopped and the pulp was collected from the centrifugal basket. In this model, the extraction of seeds was found to be 85 per cent. This was a very big machine and hence could not be adopted for domestic and small scale purpose.

Kachru and Sheriff (1992) tested a power operated axial flow seed extractor for its performance with five vegetable fruits, viz. tomato, aubergine, watermelon, muskmelon and pumpkin. Capacity of the machine ranged between 220-960 kg/h. The seed extraction varied from a maximum of 2.81 per cent for aubergine to a minimum of 0.17 per cent for tomato. Seed loss ranged between 0.82 per cent and 15.02 per cent and the mechanical damage between 0.97 per cent and 5.79 per cent. Germination was 93 per cent for tomato and 59.8 per cent for aubergine.

Mohanty *et al.* (1997) developed a vegetable seed extracting device, which consisted of a fixed cylindrical casing with rotating shaft, a sieve, and cutting, crushing and conveying blades. Three sets of blades were arranged in a row of varying length and they conveyed the pulp forward. The seed and pulp were collected at the outlet and sieved. The capacity was 210 kg/h at 370 rpm and an average of 2.9 g/kg extracting rate.

More *et al.* (1995) designed a power operated seed extractor. The machine consisted of hopper, shaft with knives, concave, outlet chute for seed and rind and a power transmission system. The machine was tested for its efficiency in separating the seed from the whole pomegranate fruit. The fruit could be fed continuously into the machine. Seed and rind came out from separate outlets. The performance was compared with hand separation of seeds. The seed separation efficiency of the machine was 86 per cent and the average purity of the seed was 96 per cent. Rind separation from the seed was very efficient. The result indicated that percentage juice in the fruit was 50.71 by weight. The capacity of the machine was estimated to be 150 kg/h. In this also flesh was cut into small pieces.

Kaliappan (1998) developed a device for the extraction of brinjal seeds. It consisted of a fruit crushing chamber and a seed separation unit. In the crushing chamber the fruits were crushed into pulp by crushing rods and adding water. The pulp and seed entered the seed separation unit just above the sieve

bottom, into a standing water column. The denser seeds sunk, passed through the sieve bottom, and got collected through the seed outlet. The capacity of the machine was 120 kg of fruits or 2 kg of seeds per hour. In this case also the flesh was crushed.

So, based on the review, it was concluded that the technologies so far developed were not suitable for recovering both the flesh and seeds of watermelon separately at the domestic and small scale level.

MATERIALS AND METHODS

Details of the theoretical considerations, the experimental set-up and the procedure adopted for the performance evaluation of the newly developed technology for the extraction of the flesh and seeds of watermelon are presented in this chapter.

3.1 Theoretical Considerations

From preliminary studies it was observed that if the flesh of the watermelon is cut into slices of certain sizes, a large number of seed loculi would be cut open exposing the seeds and consequently the seeds can be got expelled by stirring and shaking on a suitable sieve. The seeds, the finer fractions of the flesh, and the juice passing through the sieve can be collected in a collector bowl. The large slices of the flesh are retained on the sieve. These slices, devoid of the seeds, can be used for preparing the beverage. The healthy sound seeds settling at the bottom of the container can be separated from the juice and the finer fractions of flesh by decantation. In some cases, if the cutting plane does not contain any part of the loculi the seeds remain still embedded in the flesh. However, the location of these seeds can be detected through the translucent slices of the flesh and can be separated by crushing such pieces individually which is now easy. These principles were adopted in the development of new technology.

3.2 Experiemntal set-up

The experimental set-up comprised the following major units.

1. A wiremesh slicer
2. A wiremesh sieve
3. A collector bowl

3.2.1 Wiremesh slicer

This was used for slicing the watermelon flesh to the required size in one stroke itself. It was observed from the preliminary studies that a diamond-shape transverse cross-section of the slice was satisfactory enough to cut through the loculi. A ring of 172 mm diameter was made from a flat of size 20 x 3 mm (Fig.3.1). Holes of 3 mm diameter were drilled on the surface of the flat and mild steel wires of diameter 1 mm were woven through the holes resulting in a diamond shaped network. The major diagonal was measured to be 32 mm and the minor was 8 mm.

3.2.2 Wiremesh sieve

This was used for separating the seeds from the flesh by stirring and shaking (Fig.3.2). It consisted of a stainless steel cylinder of height 140 mm and diameter 130 mm. The bottom was woven with mild steel wires of diameter 1 mm to make a square mesh of size 8 mm x 8 mm. As the mesh was smaller compared to the size of the slicer, the pieces of flesh were retained on the sieve and the seeds were allowed to pass through.

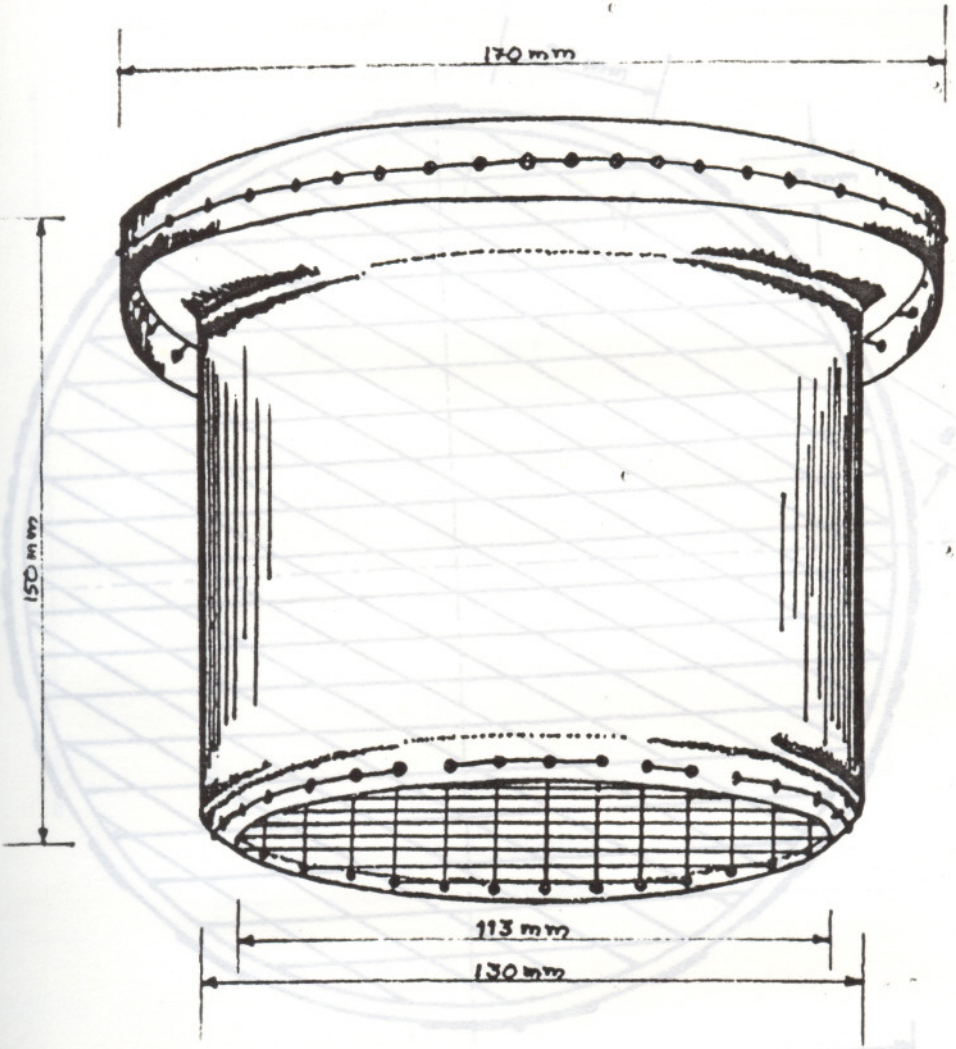


FIG.3.1 WATERMELON SEED EXTRACTOR

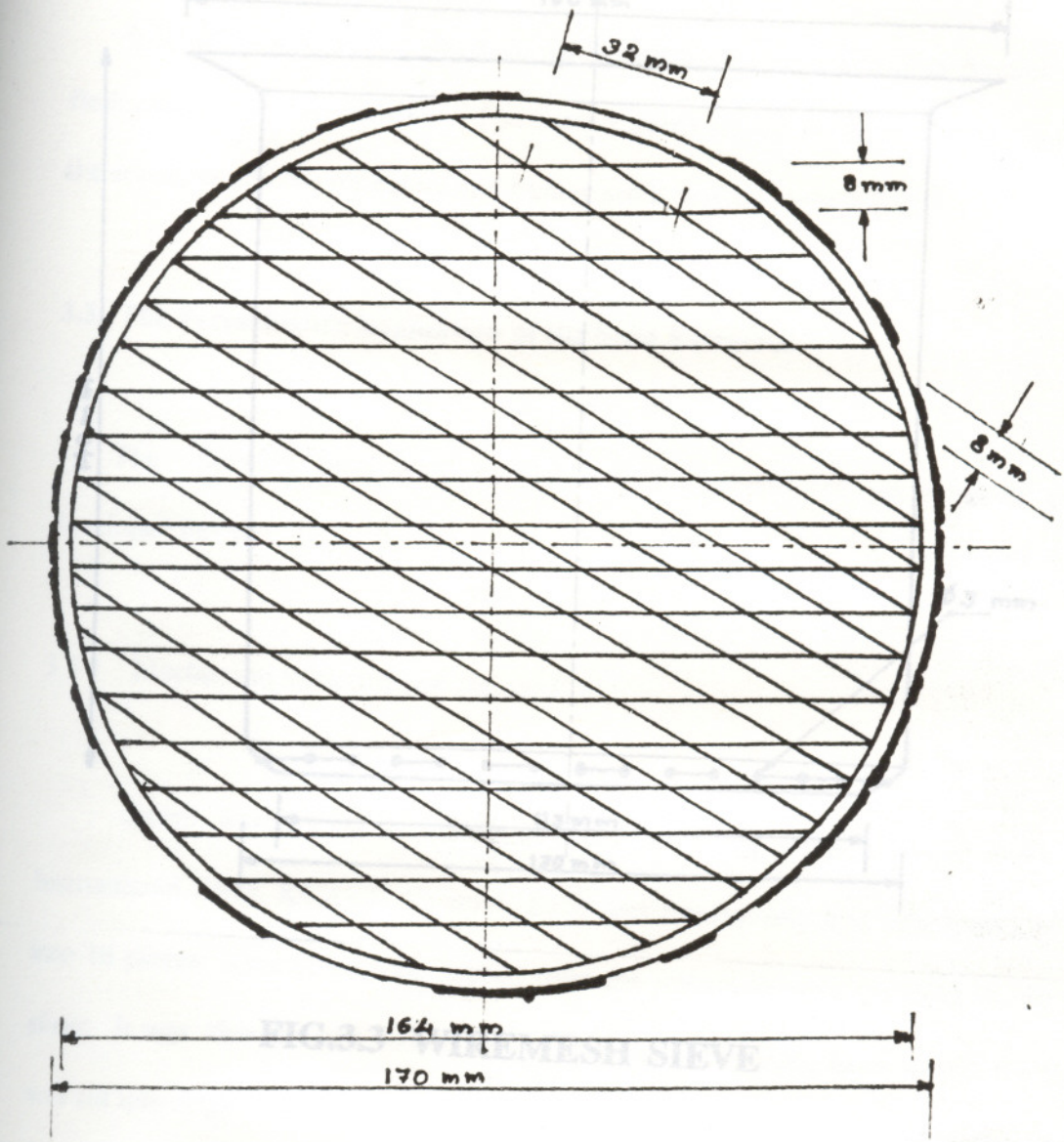


FIG.3.2 WIREMESH SLICER

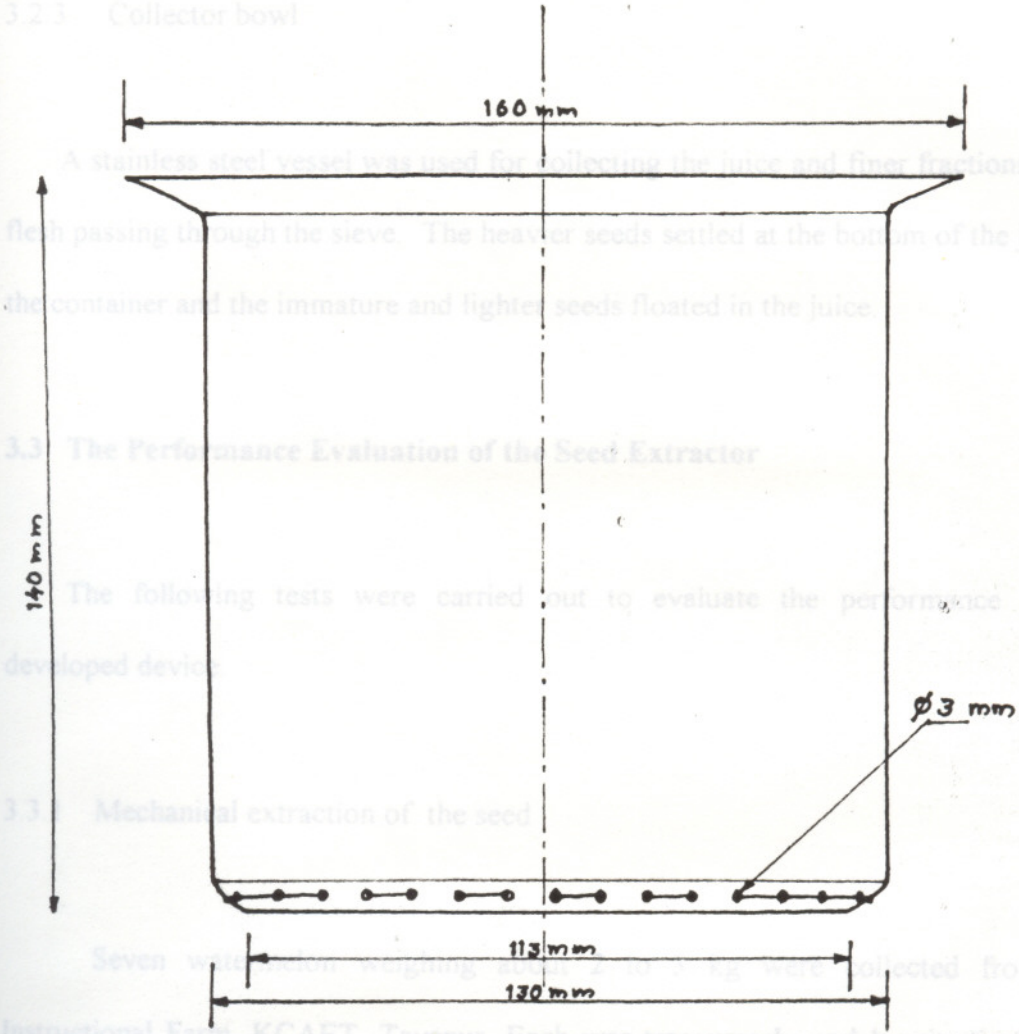


FIG.3.3 WIREMESH SIEVE

3.2.3 Collector bowl

A stainless steel vessel was used for collecting the juice and finer fractions of the flesh passing through the sieve. The heavier seeds settled at the bottom of the juice in the container and the immature and lighter seeds floated in the juice.

3.3 The Performance Evaluation of the Seed Extractor

The following tests were carried out to evaluate the performance of the developed device.

3.3.1 Mechanical extraction of the seed

Seven watermelon weighing about 2 to 3 kg were collected from the Instructional Farm, KCAET, Tavanur. Each was transversely and longitudinally cut into 16 pieces. One piece was placed over the wiremesh with the flesh facing the slicer. It was then pressed and rotated against the slicer using hand so that the flesh was cut into finger-like slices and got detached from the rind. The sliced flesh and the detached seeds were allowed to fall on the wiremesh sieve which was placed below the wiremesh slicer. By shaking, the seeds along with some watery juice were collected in the collector bowl placed below the wiremesh sieve. Larger sized flesh were retained on the sieve and the sound seeds were found to be settled at the bottom of the collector bowl. The immature and lighter seeds floating in the juice were drained out by spilling. The juice and the finer fractions were then collected. The

heavier seeds settled at the bottom were then separated by the method of decantation. This was repeated for all the pieces.

3.3.2 Capacity

Capacity is defined as the total weight of watermelon from which the seeds were extracted per unit time.

$$\text{Capacity (kg/h)} = \frac{\text{Total weight of watermelon processed (kg)}}{\text{Time taken for extraction (h)}}$$

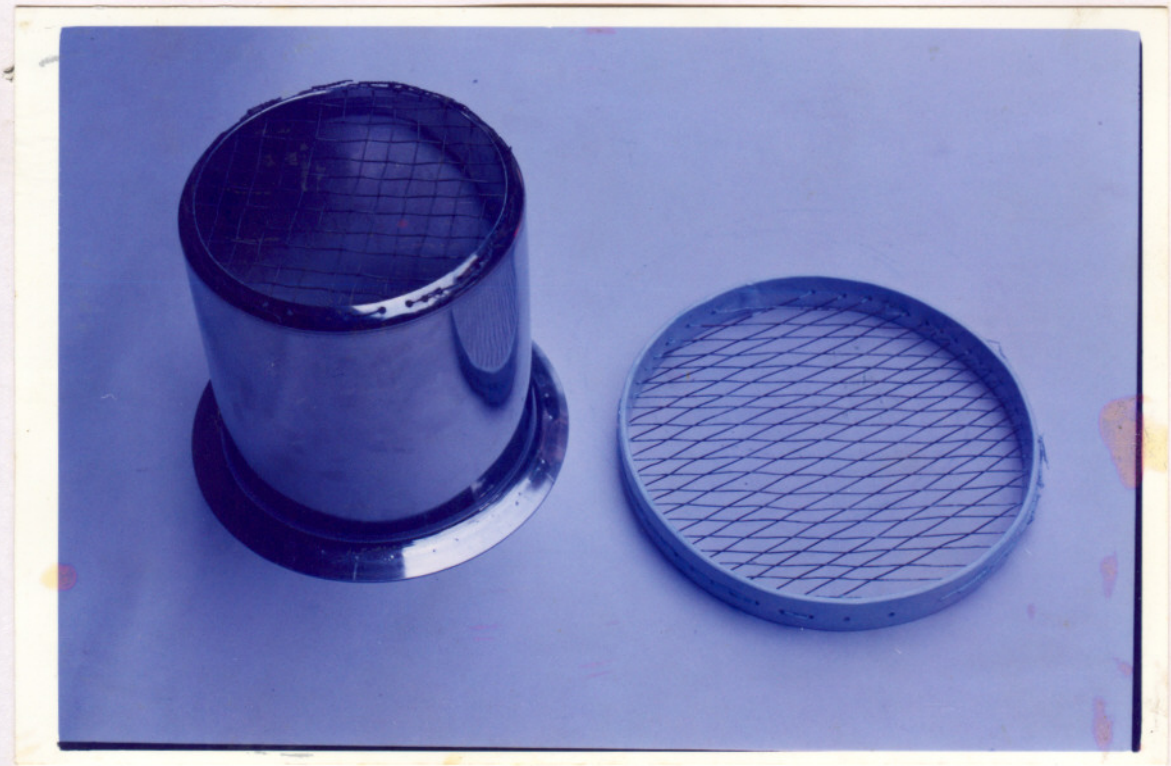
The watermelons were weighed. The time taken for cutting and extraction were recorded separately. These were used in the determination of capacity.

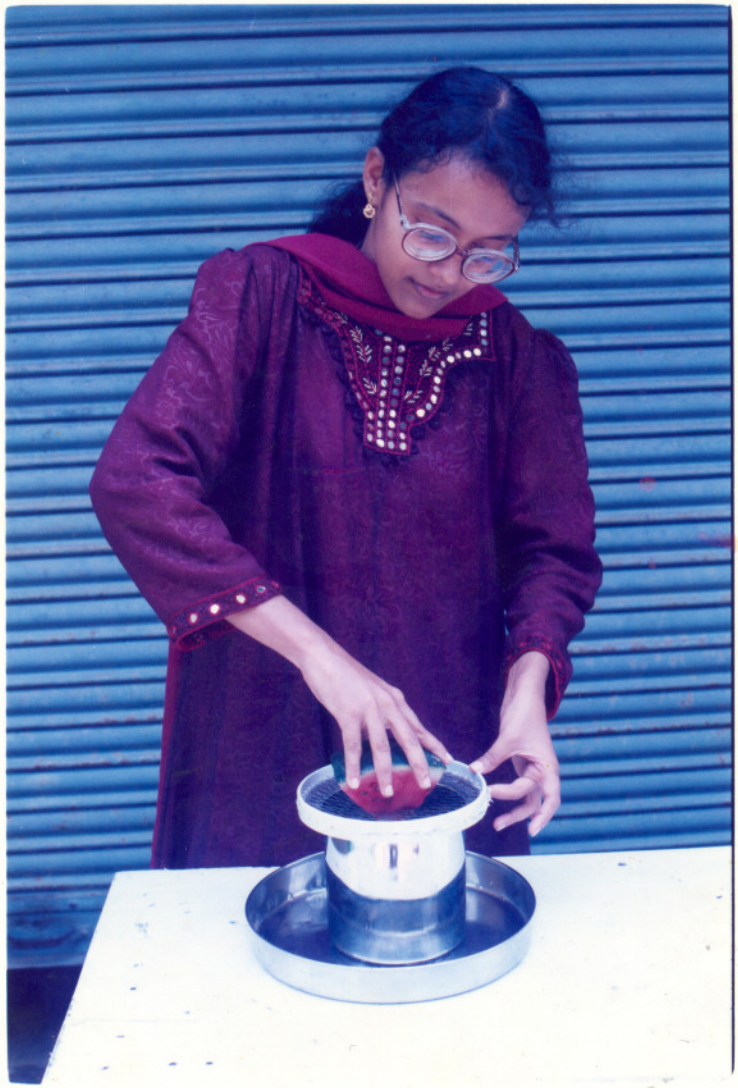
3.3.3 Seed extraction percentage

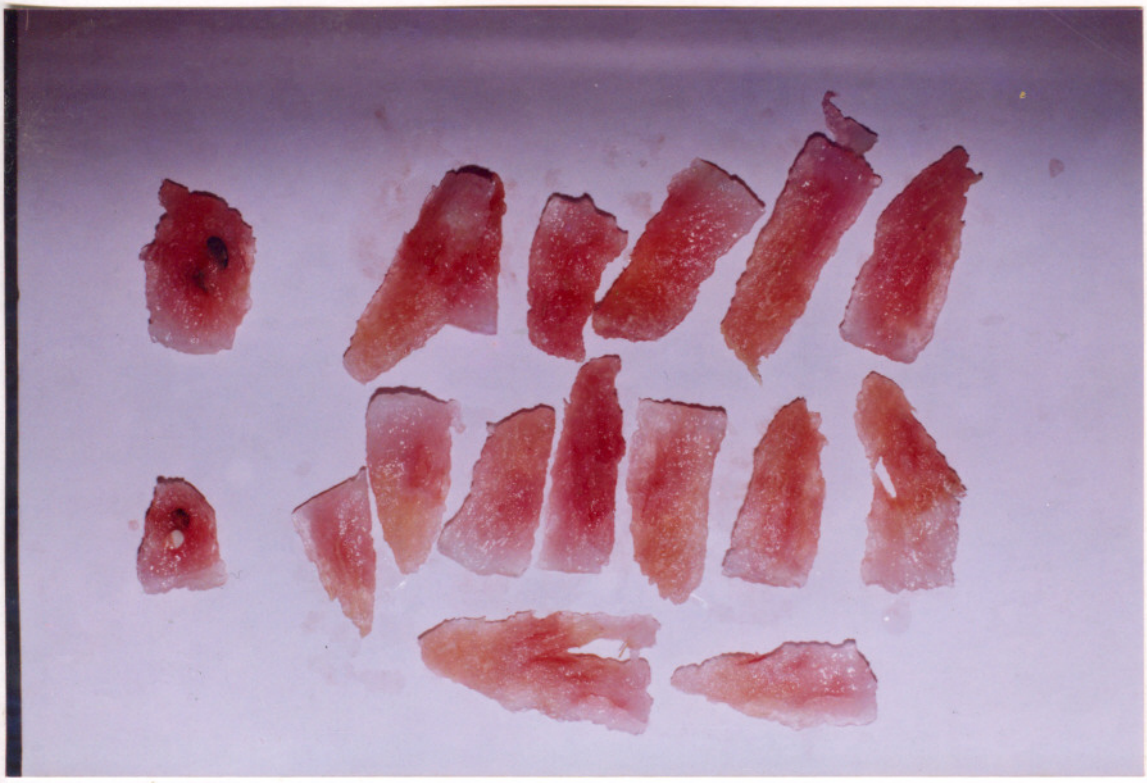
This is the percentage of weight of seeds freely extracted from the slices to the total weight of seeds originally contained in each watermelon.

$$\text{Seed extraction percentage (\%)} = \frac{\text{Weight of freely extracted seeds (g)} \times 100}{\text{Total weight of seeds originally contained (g)}}$$

The weight of seeds freely separated by slicing, stirring and shaking was recorded for each watermelon. The seeds embedded in the slices were removed by crushing the slices. The weight of those seeds were also recorded. The total weight of seeds originally contained was determined by adding up these two weights.







3.3.4 Flesh loss percentage

This is the percentage of weight of flesh lost along with the seeds to the total weight of flesh extracted from the watermelon.

$$\text{Flesh loss percentage (\%)} = \frac{\text{Weight of flesh lost along with seeds (g)} \times 100}{\text{Total weight of flesh extracted (g)}}$$

The flesh remaining with seeds, both floating and settled, were removed and weighed. The total weight of flesh extracted was determined by adding to this weight, the weight of slices retained on the sieve and the weight of juice and finer fractions of the flesh present in the juice.

3.3.5 Mechanical damage

This test was done to find out the extent of the damage to the seeds during the mechanical extraction. A representative sample was drawn from each of the seed lots separated by both manual and mechanical means for germination studies. Two replicates of both the methods were used in the study.

Germination test using sand was adopted for the test. The seeds were placed in a uniform layer of moistened sand over which 1 cm loose sand was spread over. On each day the number of seeds germinated was checked and noted.

3.3.6 Manual seed extraction

This study was conducted in the farm of the college, where women labourers were manually removing the seeds from watermelons. The capacity and the seed extraction percentage were determined after noting the relevant parameters, as earlier stated.

In the manual method, seeds were scooped out using the index finger after cutting the watermelon into 8 pieces and removing the centre core.

3.3.7 Cost of extraction

This was worked out based on the number of labourers required and the cost of equipment developed. Comparison was made with that of manual method also.

The weight of watermelon dealt by one labourer per day was determined from observation. The wage rate was also noted. From this, the cost of seed extraction per unit weight of watermelon was calculated. Similarly, the cost of the equipment was also considered. The cost of the two methods were then compared.

The data collected from the studies were utilised for arriving at the results and the conclusions which are presented in the subsequent chapters.

RESULTS AND DISCUSSION

The performance of the newly developed seed extractor was tested and the results are given below.

4.1 Capacity

The capacity was determined based on the weight of watermelon from which seeds were extracted and the time taken for the same. The analyses of data indicated that the capacity varied from 18.3 kg/h to 29.7 kg/h with a mean value of 24.16 kg/h and a standard deviation of 3.97. At the same time the capacity for manual method was from 20.5 kg/h to 21.9 kg/h with a mean value of 21.2 kg/h (Table 4.1).

It was seen that mechanical method is quicker than manual method. Besides, in mechanical method, the flesh and juice could be recovered for edible purpose whereas this was not possible in the manual method.

4.2 Seed extraction percentage

The analyses of data indicated that the seed extraction percentage was higher in the case of manual method than in the method developed under the study. The percentage of seed extracted varied from 99.06 per cent to 100 per cent in the manual method and from 87.1 per cent to 99.2 per cent in the method developed. The standard deviation of the former was 1.7 whereas it was 4.2 in the case of the latter. This is mainly because of the manipulation that can be effected by the hands subsequent to visual inspection. However, in the method developed in the study, the flesh was almost recovered fully (Table 4.2).

Table 4.1 Time taken and capacity using the newly developed device

Sl.No	Weight of watermelon (rounded off to nearest 0.250 kg (kg)	Cutting time (sec)	Extraction time (sec)	Total (sec)	Capacity (kg/h)
1	2.000	65	394	459	18.3
2	1.750	59	315	375	20.0
3	2.250	56	349	405	23.2
4	2.500	62	303	365	29.7
5	2.000	50	287	337	25.1
6	2.250	57	318	375	25.5
7	2.750	61	339	400	29.2

4.3 Flesh loss percentage

The flesh loss in the case of manual method was almost 100 per cent. This is because the flesh, after manipulation by bare hand, was unhygienic and was discarded. However, this could be reversed by making use of gloves. In respect of the method developed, the flesh loss percentage varied from 5 to 7 per cent. This is only a negligible quantity. In this method, the flesh is untouched by hand. Moreover, the flesh recovered is in slices of convenient sizes and hence can be used in the beverage.

4.4 Mechanical damage

The test for germination percentage indicated that the manual method was better than the method developed The result showed that the germination percentage varied from 90 per cent to 100 per cent in respect of manual method. But, these values were 85 per cent and 100 per cent respectively for the method developed. The variation between the manual method and the present method is not justifiable because the pressure exerted while cutting with the wiremesh slicer is not that large enough to cause damage to the embryo. Further, the stirring and shaking is also not that intensive enough to cause damage. Therefore, the variation noted is unexplained (Table 4.3)

4.5 Cost of Operation

The cost of seed extraction worked out to be Rs.0.50 per kg of watermelon for manual method whereas it was Rs.0.40 per kg for the method developed From the above it is obvious that mechanical method is cheaper than manual method.

Table 2. Results of seed extraction using newly developed equipment

Sl. No	Weight of material retained in the sieve			Weight of material collected in the collector bowl			Number fraction of seeds		Total weight of seeds	Total weight of flesh	Seed extraction percentage	Flesh loss percentage
	Flesh (g)	Flesh + seed (g)	Seeds (g)	Seeds (g)	Flesh (g)	Juice (g)	Extracted (No.)	Embedded (No.)	(g)	(g)	(%)	(%)
1	841.6	171.7	9.45	81.2	31.3	180.3	524	63	90.7	1035.15	89.6	3.1
2	689.4	118.4	7.2	86.0	52.9	205.3	555	48	93.2	853.5	92.3	6.2
3	1043.7	80.5	5.4	103.4	84.0	338.5	666	36	108.8	1202.8	95.0	7.5
4	1126.1	40.8	1.2	97.9	77.0	295.9	632	8	99.1	1242.7	98.8	6.2
5	848.0	152.8	8.1	91.7	49.8	114.2	592	54	99.8	1042.5	919	4.8
6	1052.7	8.9	0.6	73.6	41.4	175.2	520	4	74.2	1102.4	99.2	3.9
7	1072.3	181.1	12.1	81.8	31.1	241.4	528	81	93.9	1272.4	87 1	2.5

Table 4.3 Germination test using sand method

Number of replications : 4

Number of seeds placed in each test : 10

Date of placement : 27.03.1999

Date	Number of seeds germinated							
	1st replication		IInd replication		IIIrd replication		IVth replication	
	Mechanical	Manual	Mechanical	Manual	Mechanical	Manual	Mechanical	Manual
28.03.99	0	0	0	0	0	0	0	0
29.03.99	0	1	0	0	0	0	1	0
30.03.99	3	3	2	3	3	4	3	3
31.03.99	5	5	6	5	5	5	6	6
01.04.99	0	0	1	1	2	1	0	1
Total germianted	8	9	9	9	10	10	10	10
Germination percentage	80	90	90	90	100	100	100	100

Therefore, based on the above results, it leads to the conclusion that the method developed in the study can be recommended for the extraction of seeds and flesh of watermelon at the domestic and small scale level.

SUMMARY AND CONCLUSIONS

Watermelon juice forms a cooling and refreshing beverage, highly valued during summer season. But the presence of seeds in the drink is always an irritant. Therefore, it requires that the seeds be removed and the flesh recovered. The commonly adopted manual extraction method is slow and all the flesh is lost during the extraction. In the commonly available multi-purpose seed extractors, there is more amount of seed damage and all the flesh is crushed and lost.

The experiment set-up comprised a wiremesh slicer, a wiremesh sieve, and a collector bowl. The fruit was cut into 16 pieces and were pressed over the wiremesh slicer one by one. The sliced flesh and detached seeds were collected on the wiremesh sieve. Then, by shaking and stirring the seeds and some amount of watery juice were collected in the collector bowl. The larger slices remained over the sieve. The sound seeds were found to be settled down in the juice.

In this method, the mean value of the weight of seeds extracted was 93 per cent and the flesh recovered was 95 per cent. Compared to manual method the former value was 6.30 per cent lower and the latter was 95 per cent higher. The quantity of flesh recovered was 95 per cent in the method developed and in the manual method it was zero. From visual observation, there was evidently no mechanical damage to the seed. But, in the germination test the percentage of germination was 92.5 per cent for

mechanical method and 95 per cent for manual method. This variation is unexplainable and therefore could be due to extraneous reasons.

The cost of extraction was Rs.0.50 per kg in the manual method and Rs.0.40 per kg in the method developed. In view of this, it is concluded that the method gives satisfactory performance in the extraction of seeds and recovery of flesh. Besides, this method is cheaper compared to the manual method. Accordingly, this method is recommended for adoption at domestic level and for small scale extraction of seeds.

REFERENCES

Devadas, C.T., Gothendapani, L. and Sivakumar, S.S. (1993). Tomato Seed Extractor. *Invention Intelligence* **28**(4):: 139-140.

Fisher, J.T. and Widmoyer, F.B.. (1977). An Inexpensive and Compact Conifer Seed Extractor. *Tree Planters' Notes* **28**(1): 14-15.

Kachru, R.T. and Sheriff, J.T. (1992). Design and Development of a Power Operated Axial Flow Seed Extractor. *Indian J. Agrl. Engg.* **2**(1): 37-40.

Kaliappan (1998). Brinjal Seed Extractor. The Hindu Daily. Sept. 19, 1998.

Mohanty, S.K., Nanda, S.K. and Das, W.K. (1997). Design, Development and Testing of a Low Cost Vegetable Seed Extracting Machine. *AMA* **28**(4): 53-56.

More, H.G., Kanawade, L.R., Salokhe, V.M. and Singh, G. (1995). Design, Fabrication and Testing of Pomegranate Seed Extractor. Proceedings of International Agrl. Conference.

Nicholas, L. (1971). A machine for Vegetable Seed Extraction. *J. Agrl. Engg.* **8**(3): 87-91.

Reed, G.L. (1981). Pressure Sprayer Eliminates Fermentation Process for Cleaning Muskmelon Seeds. *Horticulture Science*. **16**(2): 1-91.

Singh, H. (1984). A new method of tomato seed extraction. *J. Res. Pb. Agric. Univ.* **21**(3): 463-465.

Verma, S.R., Singh, H. and Kalkat, H.S. (1992). Design Aspects and Performance of an Axial Flow Vegetable Seed Extracting Machine. *AMA*. **23**(2).

APPENDIX - I

Nutrient status of Watermelon (contents per 100 gm of edible fruit)

Water	:	92 g
Carbohydrates	:	7.0 g
Phosphorus	:	7 mg
Thiamine	:	0.05 mg
Ascorbic acid	:	6 mg
Protein	:	1 g
Calcium	:	7 mg
Vitamin	:	599 I.U
Riboflevin	:	0.05 g

APPENDIX - II

Specification of the newly developed watermelon seed extractor

Sl.No.	Item		Dimension
1.	Overall height	:	150 mm
2.	Diameter of slicer	:	170 mm
3.	Diameter of sieve	:	130 mm
4.	Overall height of sieve cylinder	:	140 mm
5.	Diameter of M.S. wire	:	1 mm
6.	Diameter of holes in the slicer ring	:	3 mm
7.	Diagonal length of slicer mesh		
	major	:	32 mm
	minor	:	8 mm
8.	Size of square mesh of sieve	:	8 mm x 8 mm

DEVELOPMENT OF A SIMPLE TECHNIQUE FOR WATERMELON SEED EXTRACTION

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ABSTRACT OF THE PROJECT REPORT

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ABSTRACT

A technology, consisting of a methodology and a system of equipments, was developed under the study for the extraction of seeds and recovery of flesh of watermelon. The watermelon was cut into small finger-like slices so as to expose the seeds for their removal by stirring and shaking on a sieve. The slices of flesh retained on the sieve are of convenient sizes to be used for the beverage. The equipment system consists mainly of a wiremesh slicer, a wiremesh sieve and a collector bowl. The mean percentage of seed extraction was 93 per cent and the flesh recovery was 95 per cent. From visual observation, there was no mechanical damage to the seeds. The germination test showed that germination percentage was 92.5 per cent. The cost of operation was Rs.0.40 per kg of watermelon. A comparison with the manual method indicated that the technique developed was comparable to that of manual method, if not better in many respects. The technique can be adopted for domestic and small scale seed extraction.