

A Plot Scale Extractor for Cucumber Seeds

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Abstract. Details are provided for construction of an extractor to be used in recovering seed from cucumber fruit (*Cucumis sativus* L.). The extractor is best-suited for handling seed lots from areas of less than one hectare, but having more than 25 to 50 fruit. The machine handles about 100 fruit per minute and recovers 98% of the seed that would be extracted by hand.

Cucumber breeding often requires harvesting large numbers of mature fruit for seed. The motorized seed extractor is more efficient than hand harvest when handling more than 50 fruit per lot. Large extractors are used by seed companies to harvest seed of the cultivars they market commercially. However, a smaller machine is preferred for research work where increase blocks are smaller than one hectare.

A machine based on commercial seed extractors used by seed companies was built and tested in Ohio by E. T. Sturgell at Campbell Institute for Research and Technology. Using that experience, a second machine was constructed at North Carolina State University as a cooperative effort of the departments of Horticultural Science and Biological and Agricultural Engineering. The machine was designed to extract seeds from mature cucumber fruit at the rate of about 100 fruit per minute. Mature fruit are defined as being past the immature, edible stage and having mature seeds. The seed extractor is easily cleaned between seed lots using water from a garden hose or from a trailer-mounted tank, or with a bucket of water and a brush if no source of running water is available.

The essential elements of the seed extractor are 2 counter-revolving, fruit-crushing rollers, a rotating drum for separating the seed from the pulp and flesh, an interconnecting gravity transfer chute, and a seed collection pan (Fig. 1). Those elements, along with a fruit loading hopper and the necessary drive components, are mounted on a 50.8 × 50.8 mm (2 × 2 inch) tubular steel

frame having a wall thickness of 3.2 mm (0.125 inch). The machine is driven by a 2237-watt (3 hp) gasoline engine equipped with a 6 to 1 gear reduction on the output shaft. A schematic flow diagram is shown in Fig. 2.

The fruit-crushing rollers are 152-mm (6 inches)-in-diam and 381-mm (15 inches)-long, and are constructed of nickel-plated mechanical tubing with 3.17-mm (0.125 inch) wall thickness. Six 1.27-mm (0.5 inch) square bars (keystock) were mounted longitudinally and equally spaced on the surface of each roller (Fig. 3) to facilitate crushing and to provide a positive feed action. The bar-to-roller surface clearance is adjustable from 6 to 13 mm (0.24 to 0.51 inch) by means of the slotted bearing mountings.

The separating drum is constructed from expanded, 16-gauge nonflattened aluminum

Table 1. Recovery and germination of cucumber seeds extracted from mature fruit by hand and by machine (plot-scale seed extractor).²

Seed harvest method	Dry seed recovered		Germination at 22°C (%)	
	Actual (g)	% of hand harvest	Actual	% of hand harvest
Hand	241	100	99	100
Machine	235	98	99	100
CV (%)	17	17	93	93
LSD 5%	508	210	1	1

²Data are means of 2 replications of 45 'Calypso' fruit each, harvested Sept. 20, 1982.

sheet, having openings of about 20 × 40 mm (0.79 × 1.57 inch). The drum is 470-mm (18.5 inches)-in-diam and 610-mm (24 inches)-long, and is open at both ends. The seeds are separated from the crushed fruit by the tumbling action of the drum and pass through the grid openings of the drum, while the pulp and flesh move axially through the drum and exit the opposite end. The drum is mounted at a slight (and adjustable) angle of less than 5° with the horizontal to facilitate movement of the material through its interior. A friction drive is incorporated in the 75-mm (2.95 inch)-diam support rollers (Fig. 4), which are flanged to assure tracking of the drum.

Power is transmitted from the engine to the separator components by a B-section V belt. An idler pulley mounted on a lever arm is employed as a clutch (Fig. 4). The crushing rollers are driven by an ASA 40-roller chain and sprocket. Chain-tensioning devices (Fig.

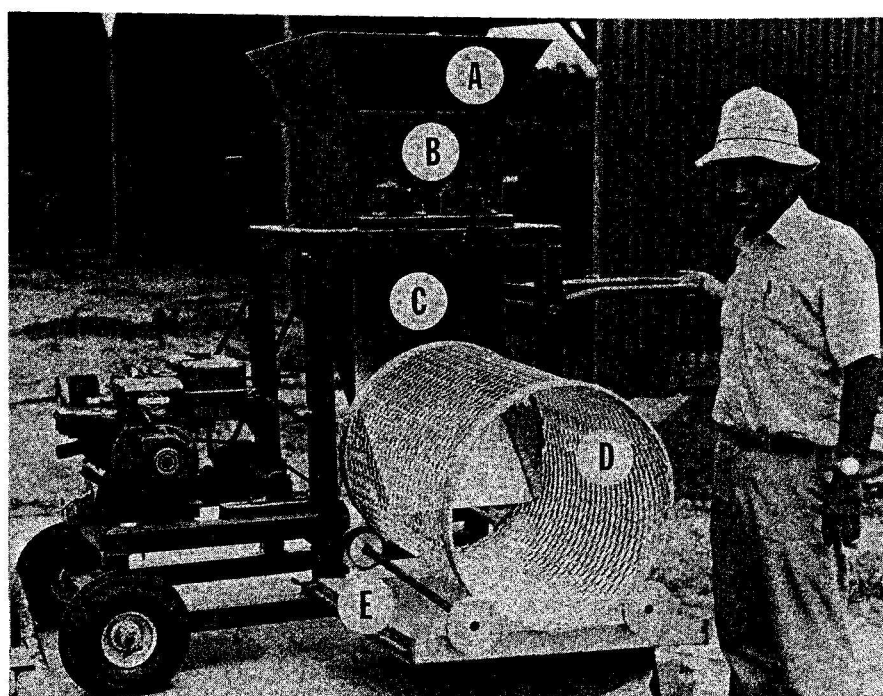


Fig. 1. Small-plot seed extractor for harvesting cucumbers. Machine is powered by a 3 horsepower gasoline engine. A) removable fruit hopper; B) housing for fruit-crushing rollers; C) stainless steel transfer chute; D) removable separating drum; E) seed collecting pan.

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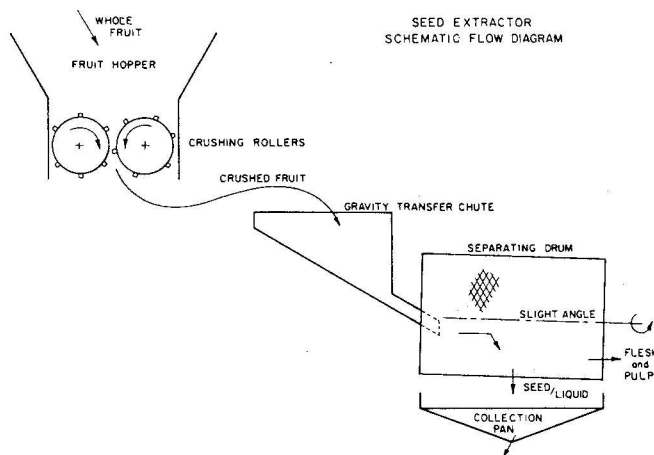


Fig. 2. Schematic flow diagram of seed extractor for cucumbers.

4) are provided to allow adjustment of the clearance between the crushing rollers. Drive ratios are such that the crushing rollers op-

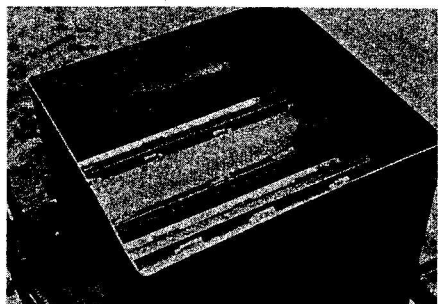


Fig. 3. Fruit-crushing rollers of the seed extractor. Fruit hopper has been removed to expose the rollers.

erate at 90 rpm and the drum at 40 rpm at an engine output shaft speed of 600 rpm; speed may be varied by means of the engine throttle.

The transfer chute is constructed from 16-gauge stainless steel and mounted directly below the crushing rollers on an angle of 45° to funnel the crushed material into the separating drum (Fig. 1). The seed collection pan is also constructed of 16-gauge stainless steel, about 530 mm by 660 mm, 51 mm deep, and is equipped with a funnel or pour spout edge to direct the seed and liquid residue into a collection bucket.

A removable fruit loading hopper (Fig. 1) above the crushing rollers directs the fruit, a

few at a time, to the rollers. The hopper and separating drum are easily removed for cleaning between seed lots. The entire machine is mounted on a trailer chassis to allow its movement from plot to plot.

A replicated test was run using both hand- and machine-harvesting methods in 1982. The machine recovered 98% of the seeds that were extracted by hand, but the difference was not statistically significant (Table 1). Germination of the seed lots harvested by the 2 methods was not statistically different either, indicating no disadvantage for the machine in recovering high quality seeds.

Blueprints of the seed extractor will be supplied by the senior author upon request.



Fig. 4. Drive system of seed extractor. F) chain-tensioning links; G) sprocket drive for fruit-crushing rollers; H) friction drive and support rollers for separating drum; I) belt drive from gasoline engine; J) belt-tightening device on main drive which serves as a clutch.