The Pharma Innovation Journal 2022; SP-11(7): 369-372

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2022; SP-11(7): 369-372

www.thepharmajournal.com
Received: 26-05-2022
Accepted: 30-06-2022

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# Seed extraction methods in tomato

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**Abstract**
The tomato, or (*Solanum lycopersicum* L.), is a member of the Solanaceae family and one of the most widely grown and processed vegetables with a significant nutritional contribution to the human diet. Even though there is a growing market for it, production is constrained by a scarcity of high-quality seeds, which is mostly due to inadequate seed extraction techniques, especially for large-scale seed production. Unsatisfactory seed extraction techniques may potentially contribute to widespread disease epidemics. There is a dearth of empirical data regarding tomato seed extraction techniques' immediate and long-term effects. To find out how different seed extraction techniques affect the physiological quality of tomato seeds and seedlings; this study was started. An entirely random design was used to conduct the experiment in both lab and field settings. The results showed that 2 percent HCl for 60 minutes produced the maximum germination percentage (99.33 and 89.76 percent under laboratory and field conditions, respectively). While the maximum weight of 1000 seeds (4.277 g) were discovered after 30 minutes of exposure to 1 percent HCl, the highest mycoora load (36 percent) was discovered after 72 hours of fermentation. However, despite the increased HCl content (2 percent and greater) and duration, no mycoora were found (60 minutes and longer time). When using a 2 percent HCl extraction method for 60 minutes, seed quality indicators like seedling length, seedling fresh weight, seedling dry weight, and vigour indices were significantly greater.

**Keywords:** Tomato, seed, pulp, extraction, fermentation

## Introduction
One of the most well-known and widely consumed vegetable crops is the tomato (*Solanum lycopersicum* L.), a member of the Solanaceae family. It also ranks first in terms of commercial and nutritional contribution to the human diet and is the most processed vegetable crop. If enhanced cultural methods and high-quality seeds are used together, tomato production can be raised even further. Fruit maturity, seed extraction techniques, fermentation duration, and fermentation temperature are few examples of the variables that affect tomato seed quality. Tomato seed mucilaginous gel contains germination inhibitors. To extract seeds, pulp and the gelatinous materials around the seed must be removed. In the seed processing process for fleshy fruited plants like eggplant, seed extraction is a crucial and initial stage. The process of extracting the seed from the fruit involves pulping it by hand or machine, followed by mechanically washing, drying, and winnowing the inert material from the seed. Different extraction techniques, such as natural fermentation, the use of chemicals, or mechanical means, can be used to remove the pulp and gel surrounding the seeds. Chemicals used frequently for tomato seed extraction include sodium carbonate, sodium hydroxide, ammonium hydroxide, hydrochloric acid, acetic acid, calcium hypochlorite, pectinases, and sulfuric acid. A classic day-neutral plant is the tomato. Fruit must set at a temperature of between 15 and 20 °C. Tomatoes are a self-pollinating plant. The location of the receptive stigma inside the cone anthers and the flower's typical pendant position both favour self-fertilization.

## Material and Methods
### Stages of seed production
Breeder seed - Foundation Seed I - Foundation Seed II - Certified Seed

### Land requirement
It's crucial to choose a location for tomato seed production where the previous harvest wasn't of the same kind to prevent contamination from stray plants.

**Isolation requirement**
Tomato seed production requires a minimum of 50 M for foundation seed and 25 M for certified seed for each variety. A minimum of 200 M is needed for the foundation (parental line increase) and 100 M is needed for certified hybrid seeds in the manufacture of hybrid seeds.

**Seed rate**
For i) Varieties - 300- 400 g/ha ii) For F1 hybrid - Male parent 25 g/ha; Female parent 100 g/ha.

**Nursery**
Sow the seeds in raised nursery bed of 20 cm height, in rows of 5 cm gap and covered with sand. Eight and ten nursery beds will be sufficient to transplant one acre. Apply 2 kg of DAP 10days before pulling out of seedling.

**Transplanting**
The best time to transplant seedlings is in the evening when they are 20 to 25 days old. Space is 60 x 45 cm (90 x 60 cm for female parent and 60 x 45 cm for male parent of hybrids).

**Manuring**
Apply 25 tonnes of FYM per ha after thoroughly preparing a field to fine tilth. 100: 100: 100 Kg of NPK/ha should be used, with 50% of the N applied as.

**Roguing**
Roguing should be carried out based on the characteristics of the plant (determinate or indeterminate), the characteristics of the leaves, branching, and spreading, as well as the size, shape, and colour of the fruit. You should eliminate the plants from the field where you grow seeds that have early blight, leaf spot, or mosaic (TMV) illnesses.

**Planting ratio**
The male and female parents are often sown in a 12:1 or 12:2 ratio to produce hybrid seeds.

**Pest and disease management**
Leaf-eating caterpillars and fruit borers are the main pests affecting tomato crops, and both can be managed by spraying. Early blight and the mosaic virus are the main illnesses affecting tomatoes. Benlate or Dithane M-45 can be sprayed to control the early blight rot.

**Harvesting**
Fruits should not be used for seed extraction from the first and last one or two harvests since they were collected after the fruit reached full maturity and turned red in colour.

**Stages of maturing**
Mature green, Breaker, Turning, Pink, Red, Dark red / over ripe.

- For seed extraction, fruits from the 6-7 harvest should be used. It is very crucial to choose appropriate seed extraction techniques because the viability of the seeds depends on how they were extracted.
- Fruits must be graded for true to type prior to seed extraction, and medium to large-sized fruits should be chosen in order to maximise the recovery of high-quality seeds.
- The most effective technique for removing tomato seeds is the acid approach. The fruits must be processed into pulp and transported in plastic containers (or a cement tank) using this procedure.
- Then, per kilogram of pulp, add 30 ml of commercial hydrochloric acid, stir well, and let it sit for half an hour. The pulp may be well churned once or twice during this interval.
- This makes it easier to separate the pulp from the seed. The floating fraction needs to be removed after the seeds have settled to the bottom after half an hour. The harvested seeds should go through three or four rounds of water washing.
- Use of iron or zinc containers must be avoided as they will reduce the viability potential of the seeds and will also cause damage to the containers due to chemical reactions with the acid.
- We must take care to use only plastic, stainless steel, or cement tanks when using the acid method.
- Using commercial hydrochloric acid at a rate of 2-3 ml/kg of seed and an equivalent volume of water for 3-5 minutes while constantly stirring, the seeds extracted by this machine can be treated once more.
- Following that, the seed should be rinsed in water four times.
- The seeds extracted using the acid method can be dried quickly and the fungus growth on the seed coat can be easily removed, giving the seeds a golden yellow colour and good vigour.
- The seeds extracted using the fermentation method have low vigour and an off colour because of fungus activity.

**Fig 1:** Took 1kg of tomatoes 22-03-2022

**Fig 2:** Sliced them to take out seed and mashed

**Fig 3:** (Took out pulp and collected in the bowl).

**Fig 4:** (With the help of sieve)

**Fig 5:** (Added some water)

**Fig 6:** Kept it in sunlight for 2 days so that fermentation can take place

**Fig 7:** (Washed and dried in a shade for a day then extracted seeds. (26-03-2022)

**Fig 8:** (Prepared pots)

**Fig 9:** (Observed germination (3-5DAS) and emergence(5-7DAS)

**Fig 10:** (29-03-2022)

**Fig 10:** 20-25DAS did transplanting and did weeding. (25-04-2022)

**Fig 11:** (Found affected area in plants by pest (serpentine leaf miner)

**Plate:** Glimpse of my research

## Results and Discussion

The acid method of seed extraction is the most effective approach for tomato seed extraction since fungal activity during fermentation may cause the seeds to be destroyed. Weekly weeding is recommended. For insect control, use neem oil. When cultivating in pots Inspections performed: The following inspections must be performed a minimum of three times: Prior to blossoming, the first examination must be conducted to confirm isolation, volunteer plants, and other pertinent characteristics, during flowering, a second inspection will be conducted to look for isolation, offtypes, and other pertinent characteristics. To confirm the genuine nature of the plant and other important elements, the third examination shall be done at maturity and before harvesting. Formula for percentage of seeds that germinate total number of seeds germinated / total number of seeds * 100.

## Conclusion

Because there is a considerable risk of fungal infection during the fermentation process, seeds can be treated with bavistin. Commercially, the acid process of seed extraction is thought to be the best. Weeding and other cross-cultural tasks need to be performed correctly if we want a high output. Prevent plant diseases like early blight, TMV, etc. by using pesticides such spraying Benlate or Dithane M-45. As I later encountered this issue and discovered numerous weeds of Celosia argentea, the land ought to be clear of voluntree plants.

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