

# Effect of Organics on Breaking of Seed Dormancy in Cardamom

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**ABSTRACT:** The experiments was carried out in the Department of Crop Improvement and Biotechnology, College of Horticulture, Sirsi, Uttara Kannada district located in hilly zone (Zone-9) of Karnataka during September - January of 2016-17. The experiment consist of eight treatments viz., T<sub>1</sub>: Cow urine @ 50% dilution for 30 min, T<sub>2</sub>: Cow dung slurry @ 50% dilution for 30 min, T<sub>3</sub>: Hot water treatment at 50°C for 2 min, T<sub>4</sub>: Vermi wash @ 50% dilution for 60 min, T<sub>5</sub>: Panchagavya @ 5% for 60 min, T<sub>6</sub>: Beejamruta @ 3% for 60 min, T<sub>7</sub>: Water soaking for 12 hours and T<sub>8</sub>: Nitric acid 25% for 10 min (Control). The germination per cent was recorded significantly highest in nitric acid treatment (80.00) at 60 days after sowing. The highest seedling quality parameters viz., root length (2.36 cm), shoot length (6.48 cm) seedling length (8.85 cm), seedling fresh weight (55.0 mg), seedling dry weight about (6.20 mg), seedling vigour index-I (707) and seedling vigour index-II (496) in nitric acid treatment.

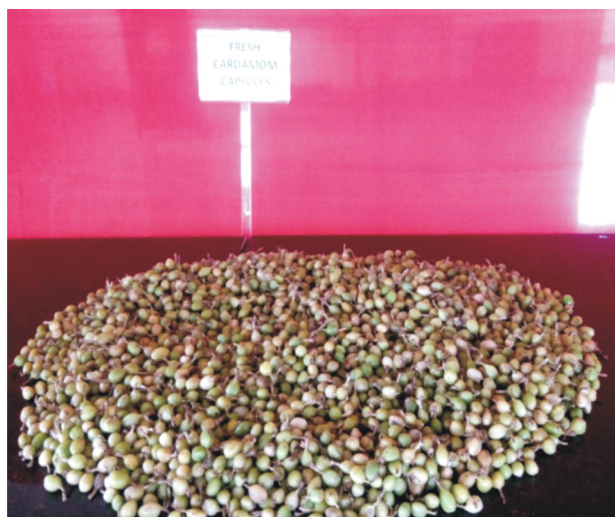
**Key words:** Cardamom, germination, seedling vigour index, Panchagavya, Beejamruta, Vermi wash

Cardamom (*Elettaria cardamomum* Maton) is a shade loving tall herbaceous perennial plant having pseudostem with branched subterranean rhizomes from which arise several erect leafy shoots. Flowers are hermaphrodite and fruit is called as capsule which is oblong or more or less globose. The seeds and pods contain essential oil which is used as a stimulant. Cardamom (*Elettaria cardamomum* Maton) is the world's third-most-expensive spice crop after vanilla and saffron. It is known as the "Queen of spices" belongs to the family Zingiberaceae. It is a native crop of India, indigenous to the evergreen forest of Western Ghats of South India. It is a shade loving tall herbaceous perennial plant having pseudostem with branched subterranean rhizomes from which arise several erect leafy shoots. Capsule contains 15-20 seeds with mucilaginous aril. Germination can be enhanced by many methods that can soften or "scarify" the hard seed coat [1] In nature, impervious seed coats are softened by microorganisms in the soil during warm periods of the season or by passage through digestive tracts of birds and mammals [2]. Hard seed coat may be broken through mechanical abrasion, alternate freezing, thawing and by fire in some of the species. On the other hand, the mucilaginous layers on the seed coverings can restrict gaseous exchange [3]. These layers of integument and remnants of the endosperm and nucellus remain

physiologically active during ripening and after the seeds are separated from the plant. Such physiologically active layers maintain primary dormancy, mainly because this semi-permeable nature restricts aeration and inhibitor movement.

## MATERIALS AND METHODS

The fresh and bold capsules of the cardamom variety Mudigere-1 was obtained from Zonal Agricultural and Horticultural Research Station, Mudigere, UAHS, Shivamoga. Mudigere-1 is a clonal selection from Malabar type, erect and compact plant and suitable for high density planting (Plate 1). Seeds extracted from the fresh capsules having the seed and seedling quality viz., moisture content of seed (45.5%), germination (69.25%), shoot length (1.98 cm), root length (10.55 cm), seedling length (12.51cm), seedling fresh weight (198.2 mg), seedling dry weight (18.00mg), seedling vigour index-I(866) and seedling vigour index-II (1246). The experiments was carried out in the Department of Crop Improvement and Biotechnology, College of Horticulture, Sirsi, Uttara Kannada district located in hilly zone (Zone-9) of Karnataka during September - January of 2016-17. The experiment consist of eight treatments viz., T<sub>1</sub>: Cow urine @ 50% dilution for 30 min, T<sub>2</sub>: Cow dung slurry @ 50% dilution for 30 min, T<sub>3</sub>: Hot water treatment at 50°C



Fresh cardamom capsules used for the experiment-I



Pre-treatment of cardamom seeds with different organics

**Plate 1.** Fresh cardamom capsules and pre treatment to cardamom seeds with different organics

for 2 min, T<sub>4</sub>: Vermi wash @ 50% dilution for 60 min, T<sub>5</sub>: Panchagavya @ 5% for 60 min, T<sub>6</sub>: Beejamruta @ 3% for 60 min, T<sub>7</sub>: Water soaking for 12 hours and T<sub>8</sub>: Nitric acid 25% for 10 min (Control) with three replications (Plate 1). The observations were recorded on germination, shoot length, root length, seedling length, seedling fresh weight, seedling dry weight, seedling vigour index-I and seedling vigour index-II. The germination test was conducted by using eight replications of fifty seeds each by adopting rolled towel method and seeds were uniformly placed on germination paper. The rolled towels were kept in a germinator maintained at a temperature of  $25 \pm 2^\circ\text{C}$  and relative humidity of  $90 \pm 5$  per cent. The germination count was taken on 30<sup>th</sup> and 60<sup>th</sup> day. The numbers of normal seedlings were counted and expressed as germination percentage (Anon., 2013) [4]. For seedling dry weight (mg), ten seedlings which were used for recording the fresh weight of seedling were kept in a butter paper bag and placed in hot air oven maintained at a temperature of  $103 \pm 2^\circ$  for  $17 \pm 1$  hour. After drying, the seedlings were kept in a desiccator for cooling. Then the weight was recorded and expressed in mg per seedling. Seedling vigour index-I was calculated by adopting the method suggested by Abdul-Baki and Anderson [5]. and expressed in whole number by using the following formulas; Seedling vigour index-I = Germination (%)  $\times$  Average seedling length (cm) and Seedling vigour index-II = Germination (%)  $\times$  Average seedling dry weight (mg).

## RESULTS AND DISCUSSION

### Seed germination (%)

The results on germination per cent of cardamom seeds for thirty and sixty days after sowing as influenced by different organic treatments and results are depicted in Table 1 and Plate 2. The germination per cent was recorded significantly highest in nitric acid treatment (63.33 and 80.00) followed by water soaking (52.00 and 68.00) and lowest (47.33 and 60.33) was recorded in beejamrutha at 30 and 60 days after sowing, respectively. The germination per cent was recorded significantly highest in nitric acid seed treatment at 60 days after sowing

The increase in germination per cent in nitric acid treatment is mainly due to water absorption was greatly facilitated by chemically damaged seed coat as hard seed coat act as a mechanical barrier to initiate germination [6]. It is evident that the dormancy reported in seeds of *Elettaria* species results from the impermeable seed coat. Any procedure which enables the seeds to imbibe moisture promotes germination [7]. The similar results were reported by [8] and Subhashini (2013) in cardamom.

However the present study envisages the importance of chemical treatments (inorganic) in breaking seed coat dormancy. Radhamani *et al.* [6] reported the cardamom seeds treated with nitric acid (25%) for ten minutes were most effective treatment in breaking seed dormancy in cardamom. Superiority of nitric acid treatment in breaking



Seed germination (%) in nitric acid treatment



Seed germination (%) in beejamrutha treatment

**Plate 2.** Germination (%) in nitric acid and beejamrutha treatment in cardamom**Table 1.** Effect of organic seed treatment on germination at 30 and 60 days in cardamom

Treatment	Germination (%)	
	30 days	60 days
T <sub>1</sub> - Cow urine (50% dilution)	47.33 (28.45)*	60.33 (37.32)
T <sub>2</sub> - Cow dung slurry (50% dilution)	44.00 (26.24)	57.33 (35.18)
T <sub>3</sub> - Hot water treatment (50° C)	43.33 (25.82)	53.33 (32.41)
T <sub>4</sub> - Vermi wash (50% dilution)	38.50 (22.76)	50.00 (30.16)
T <sub>5</sub> - Panchagavya (5%)	40.33 (23.91)	52.00 (31.50)
T <sub>6</sub> - Beejamruta (3%)	38.00 (22.45)	48.00 (28.84)
T <sub>7</sub> - Water soaking	52.00 (31.50)	68.00 (43.08)
T <sub>8</sub> - Nitric acid (25% dilution)	63.33 (39.52)	80.00 (53.44)
Mean	45.85 (27.58)	58.62 (36.49)
S. Em±	1.02	0.79
CD @ 5%	3.06	2.36

\*- Values in parenthesis indicates arc sine transformed data

hard seed coat dormancy in present study may be due to increase in absorbance of water, enzymatic activities and enhance the rapid germination [9]. Water absorption was greatly facilitated by chemically damaged seed coat (Jones *et al.*) [10] and observed during first four weeks for most seeds, water absorbed through hard seed coat act as a mechanical barrier to initiate germination. But

with the water absorption gradually soften the seed coat and hence induce [11]. Any procedure which enables the seeds to imbibe moisture promotes germination and observed low seed germination percentages of *Elettaria* species because of hard seed coat that act as a physical barrier for germination Further, similar findings to increase germination in seeds treated with nitric acid was also reported by [12] in ashwagandha, [13] in *acacia*, [14] and Dahanayake [15] in cardamom.

### Seedling quality parameters

The data on root, shoot and seedling length, seedling fresh and dry weight and seedling vigour index I and II as influenced by different organic treatments and results are presented in Table 2 and 3. The treatment nitric acid has recorded highest root length (2.36 cm), shoot length (6.48 cm) seedling length (8.85 cm), seedling fresh weight (55.0 mg), seedling dry weight about (6.20 mg), seedling vigour index-I (707) and seedling vigour index-II (496) followed by water soaking (2.09 cm, 6.18cm, 8.28 cm, 53.0 mg, 5.97 mg, 562 and 406, respectively). The lowest root length (1.46 cm), shoot length (3.76 cm), seedling length (5.23 cm), seedling fresh weight (31.0 mg), seedling dry weight (3.47 mg), seedling vigour index-I and seedling vigour index-II (166) was recorded in beejamrutha at 60 days after sowing. The treatment nitric acid has recorded highest root length, seedling length, seedling fresh weight and seedling dry weight. The highest seedling quality parameter may be due to acid treatment softening the hard seed coat as well as help for absorption of moisture which leads to improvement

**Table 2.** Effect of organic seed treatment on root length, shoot length and seedling length at 60 days in cardamom

Treatments	Root length (cm)	Shoot length (cm)	Seedling length (cm)
T <sub>1</sub> - Cow urine (50% dilution)	1.95	5.69	7.64
T <sub>2</sub> - Cow dung slurry (50% dilution)	1.88	5.63	7.51
T <sub>3</sub> - Hot water treatment	1.85	5.54	7.39
T <sub>4</sub> - Vermi wash (50% dilution)	1.60	4.88	6.49
T <sub>5</sub> - Panchagavya (5%)	1.71	5.15	6.86
T <sub>6</sub> - Beejamruta (3%)	1.46	3.76	5.23
T <sub>7</sub> - Water soaking	2.09	6.18	8.28
T <sub>8</sub> - Nitric acid (25% dilution)	2.36	6.48	8.85
Mean	1.86	5.41	7.28
S. Em±	0.05	0.21	0.23
CD @ 5%	0.16	0.64	0.70

**Table 3.** Effect of organic seed treatment on seedling fresh weight, dry weight and vigour index at 60 days in cardamom

Treatments	Seedling fresh weight (mg)	Seedling dry weight(mg)	Seedling vigour index-I	Seedling vigour index-II
T <sub>1</sub> - Cow urine (50% dilution)	50	5.63	462	340
T <sub>2</sub> - Cow dung slurry (50% dilution)	49	5.50	430	316
T <sub>3</sub> - Hot water treatment	48	5.40	394	288
T <sub>4</sub> - Vermi wash (50% dilution)	37	4.97	326	248
T <sub>5</sub> - Panchagavya (5%)	47	5.40	357	281
T <sub>6</sub> - Beejamruta (3%)	31	3.47	250	166
T <sub>7</sub> - Water soaking	53	5.97	562	406
T <sub>8</sub> - Nitric acid (25% dilution)	55	6.20	707	496
Mean	46	5.32	436	318
S. Em±	1.24	0.09	13.44	8.15
CD @ 5%	3.72	0.28	40.31	24.44

of seedling emergence rate due to enhanced supply of soluble carbohydrates to the growing embryo. The increase in root and shoot length by pre-sowing treatment due to the beneficial effect in uniform germination, due to intensify hydrolytic process, better uptake of nutrients and moisture, importing stimulation for better establishment of seedling. Similar beneficial physiological and bio-chemical effect of pre-sowing treatments with nutrient solution, were also observed by [16] in *Ocimum sanctum*.

Nitric acid treatment has showed highest seedling vigour index-I and seedling vigour index-II (707 and 496, respectively). Since the germination percentage and seedling length and dry weight were found highest hence higher seedling vigour index-I and seedling vigour index-II was observed maximum. Similar report of pre-sowing treatments with KNO<sub>3</sub> in Ashwagandha seeds found to be very effective in seedling parameters was observed by [11].

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