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# Effect of gibberellic acid on seed quality of coriander (*Coriandrum sativum* L.)

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**Abstract**
The experiment was conducted to study the effect of gibberellic acid on seed quality of coriander (*Coriandrum Sativum* L.) cv. Hisar Sugandh and Hisar Bhoomit. In the present experiment, gibberellic acid concentration 50 ppm was sprayed at three different stages of crop growth (Seed soaking, Spray at leaf stage and Spray at 50% flowering stage). Gibberellic acid was sprayed in eight treatment combinations of three stages. Based on the experimental results, it was concluded that application of gibberellic acid improved the quality of coriander seeds. Test weight, germination percentage, Seed vigor index-I and Seed vigor index-II were observed maximum with (Seed soaking+ Spray at leaf stage+ Spray at 50% flowering stage) followed by (Spray at leaf stage+ Spray at 50% flowering stage). Among both the varieties, the variety Hisar Bhoomit found better for germination per cent while Hisar Sugandh performed better for test weight, vigor index.

**Keywords:** Coriander (*Coriandrum Sativum* L.), gibberellic acid, seed quality

## Introduction
Seed spices are annual herbs, whose dried seeds or fruits are used as spices. They are nature"s gift to humankind as they add flavour to our food. In addition, they also have preservative and medicinal values. (Anonymous, 2015) [1]. Coriander seed have aromatic odour and taste of coriander fruits due to an essential oil, which is made up of hydrocarbon and oxygenated compounds. Besides the essential oil, the seed contain 16.1% fatty oil, 14.1% protein, 21.6% carbohydrate, 32.6% fibers, 11.2% moisture and 4.4% mineral matters and coriander leaves are rich source of vitamin A and Vitamin C (Singh *et al*., 2017) [11] Plant growth regulators (PGRs), have emerged as magic chemical that could increase agricultural production at an unprecedented rate and help in removing or circumventing many of the barrier imposed by genetics and environment (Nickel, 1982) [5]. Effectiveness of PGRs depends upon several factors viz. concentration, methods and time of application, etc. As such different modes (seed soaking, foliar spray, soil application, stem injection, etc.) of application of PGRs alter the physiology of plant in different ways. It is well known that all the PGRs regulate the physiological functions/processes of the plant. Among different PGRs, NAA and $GA_3$ has been reported to boost the growth, yield and quality attributes in coriander. Gibberellic acid is found to be one of the most important means to increase yield and seed quality in many of the seed spices like fenugreek, coriander and cumin. Keeping in view the above facts, the present experiment has been conducted to study the effect of $GA_3$ on seed quality of coriander.

## Material and methods
The field experiment was conducted during Rabi season of 2016 -17 at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, and Hisar. The seed material used for the present investigation was varieties Hisar Sugandh and Hisar Bhoomit, which was procured from the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar (Haryana). In the present experiment, one gibberellic acid concentration (50 ppm) including control was sprayed at three different stages of crop growth, Seed soaking (8 hrs.), spray at leaf stage and spray at 50% flowering stage. Eight treatment combinations of one variety are laid out in Randomized Block Design were replicated thrice of both varieties making total of 48 plots. Need based cultural and plant protection operations were taken up to harvest. The experimental data was analyzed statistically by the method of analysis of variance as outlined by Panse and Sukhatme (1961) [8].

## Experimental details
Design: Randomized Block Design
Replications: Three

Treatment combination: 16
Total plots: 48
Plot size: 3.0x2.4m
Plant spacing: 30 x 20 cm
Date of sowing: 6th Nov. 2016

**Stages of application**
1. Seed soaking (8 hrs.)
2. Spray at leaf stage
3. Spray at 50% flowering stage

**Treatment combinations**
T1: Control (Water Spray)
T2: Seed soaking ($GA_3$@50ppm)
T3: Spray at leaf stage (30 DAS) ($GA_3$@50ppm)
T4: Spray at 50% flowering stage ($GA_3$@50ppm)
T5: Spray at leaf stage+ Spray at 50% flowering stage ($GA_3$@50ppm)
T6: Seed soaking+ Spray at leaf stage ($GA_3$@50ppm)
T7: Seed soaking+ Spray at 50% flowering stage ($GA_3$@50ppm)
T8: Seed soaking+ Spray at leaf stage+ Spray at 50% flowering stage ($GA_3$@50ppm)

**Seed quality parameters**
**Test weight (g)**
One thousand seeds replicated thrice in each genotype were counted, weighed and average seed weight of each genotype was calculated.

**Standard germination (%)**
Hundred seeds of each genotype in four replicates were placed in between sufficient moistened rolled towel papers and kept at 25ºC in seed germinator. The final count was taken on 21st day and only normal seedlings were considered for percent germination according to the rules of International Seed Testing Association (ISTA, 1999) [3].

**Seedling length (cm)**
Seedling length of ten randomly selected normal seedlings from three replication of standard germination test was measured to get the average seedling length in centimeter.

**Seedling dry weight (mg)**
Ten normal seedlings selected for measuring seedling length were further kept in hot air oven for taking dry weight. These are dried at 80 ºC for 48 h and the seedling dry weight was recorded in milligram. At last average weight of ten seedlings was taken for further calculation.

**Seedling vigour index: (ISTA 1999) [3].**
**Vigour index-I**
Vigour index-I was calculated by multiplying the standard germination (%) with seedling length (cm).
Vigour index-I = Standard germination (%) x seedling length (cm).

**Vigour index-II**
Vigour index-II was calculated by multiplying the standard germination (%) with seedling dry weight (mg).
Vigour index-II = Standard germination (%) x seedling dry weight (mg).

**Results and discussion**
The perusal of data revealed a significant variation among different treatment for test weight, germination percentage, vigor index-I and vigor index-II. The data pertaining to test weight is presented in table 1. The values for test weight ranged from 12.78 to 14.51 g for Hisar Sugandh and 7.39 to 9.11 g for Hisar Bhoomit. The maximum value for test weight was noticed with (T8) Seed soaking+ Spray at leaf stage+ Spray at 50% flowering stage for both varieties. Hisar Sugandh has maximum test weight (14.51g) as compared to Hisar Bhoomit. Present results might be due to enhanced physiological activities like photosynthesis and translocation of nutrients and photosynthates (Saxena, 1989) [9]. The results also support the findings of Singh (2014) [10] in coriander and Talab *et al.* (2014) [12] and Krishnaveni *et al.* (2016) [4]
The values for germination varied from 86.67 to 92.67% for Hisar Sugandh and from 89.6 to 93.17% for Hisar Bhoomit. The maximum mean value for germination percentage was recorded with T8 for both varieties. If we compare both varieties, germination percentage was better in Hisar Bhoomit. Increased germination percentage might be attributed to the induction of synthesis of α-amylase, protease and other hydrolytic enzymes by the applied gibberellic acid. Gibberellic acid also appears to induce the activity of gluconeogenic enzymes during early stages of seed germination (Pandey and Sinha, 1995) [7]. The results support the findings of Nikkhah *et al*. (2012) [6] in black cumin.

**Table 1:** Effect of gibberellic acid applied at different stages on test wt., germination percentage, vigour index-I and vigour index-II in coriander.

| Treatments | Test weight (g) | | Germination (%) | | Vigour Index-I | | Vigour Index-II | |
|---|---|---|---|---|---|---|---|---|
| | Hisar Sugandh | Hisar Bhoomit | Hisar Sugandh | Hisar Bhoomit | Hisar Sugandh | Hisar Bhoomit | Hisar Sugandh | Hisar Bhoomit |
| T1 | 12.78 | 7.39 | 86.67 | 89.6 | 2263 | 1968 | 2110 | 2641 |
| T2 | 13.36 | 7.87 | 88 | 90.47 | 2405 | 2035 | 2230 | 2762 |
| T3 | 13.86 | 7.93 | 87.33 | 90.53 | 2337 | 2080 | 2351 | 2888 |
| T4 | 14.08 | 8.56 | 90.33 | 91.87 | 2532 | 2171 | 2541 | 3059 |
| T5 | 14.28 | 9.02 | 92 | 92.83 | 2677 | 2258 | 2613 | 3243 |
| T6 | 13.87 | 7.97 | 90 | 91.2 | 2466 | 2101 | 2481 | 2937 |
| T7 | 14.17 | 8.83 | 91.67 | 92.03 | 2655 | 2221 | 2558 | 3154 |
| T8 | 14.51 | 9.11 | 92.67 | 93.17 | 2739 | 2317 | 2700 | 3276 |
| C.D. at 5% | 0.79 | 0.73 | 2.66 | 1.98 | 131 | 97 | 198 | 112 |

The data also showed that the maximum value for the vigor index-I and vigor index-II was recorded with T8 for both varieties. Hisar Sugandh show maximum vigour index-I (2739). Hisar Bhoomit show maximum vigour index-II (3276). The improvement in vigour index might be attributed to improved germination which was due to stimulation of

enzymatic activities. This might also be due to good seedling growth caused by improved mobilization of food reserves. The results are in accordance with the findings of Dhungel *et al.* (2007) [2] who reported significant increase in vigour index of chilli with the application of gibberellic acid.

## Conclusion

Based on the experimental results, it was concluded that application of gibberellic acid improved the quality of coriander seeds. (Seed soaking+ Spray at leaf stage+ Spray at 50% flowering stage) was the right combination for gibberellic acid application to improve the quality of coriander seed. In case of spray at two stages, Spray at leaf stage + Spray at 50% flowering was the right combination to improve the seed quality like test weight, germination (%), vigor index-I and vigor index-II.

Test weight, germination percentage, Seed vigour index-I and Seed vigour index-II were observed maximum with (Seed soaking+ Spray at leaf stage+ Spray at 50% flowering stage) followed by (Spray at leaf stage+ Spray at 50% flowering stage). Among both the varieties, the variety Hisar Bhoomit found better for germination per cent while Hisar Sugandh performed better for test weight, vigor index

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