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Methods of vegetable seed treatment and its effect: A review

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Abstract
Quality seed is prime requirement of vegetable production. Seed carries all genetical information from one generation to next generation for yield, biotic and abiotic stress resistance. Maintenance of genetic purity of seed is mandatory task of seed production on field *viz*., by using isolation distance and removal of unwanted plants which are responsible for genetic contamination. Similarly storing seed for long duration upto next season with proper quality is very important part of every seed production program. As vegetable seeds comes under category of low volume high value it is important to maintain seed health and viability upto next generation. Number of different seed treatment methods are used in vegetables during storage and before sowing but to choose sustainable and eco-friendly method with better result for seed quality enhancement is very important decision for every seed producer.

Keywords: Seed, vigour, treatment, germination, vegetables

Introduction
Day by day importance for vegetables is increasing in diet of Indian people due to awareness of food and health. In 20th century Horticulture sector represents itself a key role in national economy. Total production of vegetables in India around 1, 84, 394 MT (Production in '000 MT) over 10, 259 ha. Of land. Per cent share of vegetable crops in Indian horticulture is reported around 59.2 per cent in last 2017-18 (Anonymous 2018).
Initial quality of seed plays vital role in every crop production and vegetable production. Maintenance of quality of seed during harvesting to storage and before sowing is important task for getting good yield. Seed is mean of trance forming genetic information and that information have ability to control productivity, insect and pest resistance, biotic and abiotic stress (Cavatassi *et al*., 2010; Bishaw, 2004) [5, 4]. Taking care of isolation distance and removing unwanted plant to reduce genetic contamination are the basic steps in seed production. Even though some storage factors and pre-germination factors responsible for deterioration of quality of seeds. Deterioration and variation in seeds may lead to failure of overall production. De Figueiredo *et al*., 2003 [8] reported that healthy vigorous seedling establishment is depends on initial quality of seed.
Seed treatment is one of the steps to maximize the production. It is done at the time of pre and post-harvest storage. Effective treatments lead to overcome the barrier due to biotic and abiotic agents.it increases the qualitative and quantitative characters of crops. Some seed invigoration treatments play greater role in enhancing germination and vigour of the seeds. Pan and Basu, 1985 reported that seed enhancement having ability to get back vigour and viability of stored vegetable (lettuce) seed which lost during storage.
Modern seed treatment includes the application of physical, chemical agents and biological agents. it offers the control of target pests and diseases and ensure the establishment of healthy and vigorous plants. The active ingredients in the formulation provide broad-spectrum, endure for long time management against pests and diseases. Modern seed treatment products are consisting of several active ingredients, special wetting agents, colorants and sometimes bird repellents which are time to time tested for their safety to the seed, the users and the environment.

Different methods of seed treatment in vegetables with its efficacy in vigour, viability and pest and diseases management
There are various types of seed treatment ranging from physical seed treatment to advanced methods like seed pelleting and seed priming.

1. **Physical seed treatment:** Govindaraj *et al.,* (2017) [11] reported that for healthy establishment of seedlings application of chemical, physical agents and techniques is called as physical seed treatment. Physical seed treatment includes hot water treatment, aerated heat treatment and radiation treatment.

a. **Hot water treatment:** Roberts (1988) [18] revealed that some seeds shows dormancy under low temperature for such kind of seeds combination of hydration with some temperature can enhance the germinability of seed and reduce the dormancy. Before exposure of seed to high temperature seed need to be soak in water having variable temperature according to crop for 10 minutes. Then transfer seed to cold water and let seed to cool and then seed should be sun dried. This seed treatment can be done in tomato, cucumber, carrot, spinach, radish.

b. **Hot air treatment:** In hot air treatment seed is treated by solarisation, where the seeds are treated by rays from the sun (Clemens *et al.* 1977) [6]. Hot air treatment help in deactivating seed borne virus and pathogen.

c. **Radiation treatment:** Use of radiation like UV radiations, gamma radiations are the not only recent advances but also it is used from many years. Use of radiations is not adapted by farmers due to unavailability of technology. Use of technology and advance methods to reduce use of chemicals and safety of environment for sustainable agriculture is main target of every nation (Pretty *et al*., 2006) [17]. Use of cultural and physical methods might shows better effect to get more good result in agriculture (Aladjadjiyan, 2012) [1].

2. **Chemical seed treatment**: There are different methods are used for treating seeds by using chemicals *viz*., dusting method, slurry method and dipping and drying methods. Copeland and McDonald (2001) [7] given conditions for good seed treatment i. Seed treatment should be effective against soil and seed born pathogens ii. Seed treatment should not harm animals and plant iii) Seed treatment should be long lasting effective and lastly economical. Gupta *et al.* (1989) [12] reported that onion seeds treated with different chemicals *viz*., thiram, captan, captafol, and cytozyme retained the germination up to 12 months.

3. **Biological seed treatment:** Various microorganism such as *Trichoderma, pseudomonas, bacillus, Trichogramma* prevents various biotic, abiotic and physiological stress of seed and improve the germination and vigor of seed. Dolas *et al.,* 2019 [9] reported that some harmful seed born pathogens having ability to reduce germination and vigor but use of some beneficial bioagent reduce the risk of infection and infestation. Begum *et al*., (1999) [3]. Seed born pathogenic fungus successfully controlled by using *Trichoderma harzianum.* Gnanamanickam *et al.* 1999 [10] reported that the Bacterial blight of rice can be controlled by using *Bacillus spp.* for seed treatment as seed coating.

4. **Seed coating:** Thin layer of fungicide and insecticide cover over seed to reduce the risk of pest and diseases. In some seed companies colored fungicides and insecticides where used to make identity of company. A method during which a thin skinny and consistent layer of surface material covers the surface of seed. Some researchers reported about effect of seed coating with biological agent found significantly good result. Palupi *et al.,* 2017 [15] reported that seed coating of *P. diminuta* A6 + *B. subtilis* 5/B showed significant role in seed vigor and controlling bacterial blight of rice crop. Basavaraj *et al.* (2008) [2] reported application of seed coating polymer and thiram recoded significantly lowest infection, higher germination, vigor and dry weight of seedlings.

5. **Seed pelleting**: Seed pelleting is very recent advances in seed technology where efficiency of applied seed treatment increased by overlapping seed with fungicides, pesticides and fertilizers. Mostly seeds pelleted for getting proper shape to seed and to make it easy for sowing and increase planting value. Manjunatha *et al.* (2009) reported that the seed pelleted with captan and imidacloprid recorded higher seed quality followed by ZnSO4 + captan + imidacloprid against unpelleted control throughout the storage period. Satish Kumar *et al.* (2014) [19] studied the effect of seed pelleting with chemicals in egg plant recoded significantly more germination and vigor.

6. **Seed priming**: Initiation of seed invigoration by seed priming first started and elaborated by Heydecker *et al.* (1973) [13]. Controlled hydration of seed is main aim of seed priming so that seed will activate some phases of seed germination and it will result in better seed germination and uniformity in seedlings. The primed seeds give earlier, more uniform and sometime greater germination and seedling establishment and growth.

Conclusion

Number different methods of seed treatments are available for treating seeds but if you want to maintain sustainable production with proper care of seed before sowing then use of physical method and bioagent method is better to get both results. Bioagent coating of seeds is most successful method for controlling pest and disease and more vigour reported by many researchers.

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