Seaweed Pretreatment of Chickpea (Cicer arietinum) Enhances Post Harvest Preservation by Reducing Germination

Ritisha D Viththalpara¹, Ajaaj R Saiyad¹, Asha J Jani¹, Dipesh R Vara¹, Prashant D Kunjadia², Gaurav V Sanghvi³,⁴, Devendra Vaishnav³ and Gaurav S Dave²*¹

¹Department of Biochemistry, Saurashtra University, Rajkot, India
²B N Patel Institute of Paramedical Sciences, Bhaletic Road, Anand, India
³Department of Pharmaceutical Sciences, Saurashtra University, Rajkot, India
⁴Max Planck Institute of Developmental Biology, Tubingen, Germany

Abstract

The plant growth enhancer property of seaweeds has been studied in different crops. Seaweed (Sargassum wightii and Ulva lectuca) were collected from coastal region of Mangrol and studied for its effect on germination and storage of chickpea. Chickpea seeds were soaked in 1% seaweed extracts for 6 h and dried at room temperature before sowing for germination in the soil. Percentage of seeds germination was less in S. wightii (67%) and U. lectuca (65%) treated seeds as compared to control. Furthermore, the treatment also prolonged germination time as compared to untreated control. Seaweed extracts effect on seeds viability upon longer storage was affected by the storage conditions. For instance, storage of seeds treated with seaweeds extracts at room temperature was more affected as compared to 4-8°C and -20°C. These results showed that seaweed extract is possible to use for increasing post harvest shelf life of chickpea without affecting its natural texture.

Keywords: Seaweed; Chickpea; Longevity; Germination

Introduction

Seaweed is natural and domestic resource of plant growth promoter also in the Gujarat coastal region. Seaweed has been used to enhance the growth and germination of various plants (8-13). Seaweeds like Sargassum, Ulva, Caulerpa, Padina, Ecklonia have been found to contain essential micronutrients such as potassium, zinc, molybdenum, nitrogen, copper, cobalt, etc. [1-3] as well as plant growth hormones like IAA, gibberellins, abscisic acid, auxins and other important phytochemical that support the growth and development of plants [4-7]. Many species of seaweeds have been found to stimulate the defense responses in the plants [8]. Many seaweeds have also been reported as a food ingredients and supplements [9-11].

Chickpea (Cicer arietinum L.) is one of most important pulse crops in the world. According to world Food and Agriculture Organization (FAO) survey published in 2011, India contributes 68% of global production of chickpea [12]. Total estimate of chickpea production has gone up to around 8567.8 thousand tones in the year 2013-14. Post harvest preservation of green chickpea is one of the hurdle that limits the full exploitation of this crop potential both in sustainable serving to people and in contributing to agriculture economy of the country as well as inaccessible warehouse facility, whereas some of them are accessible only in fair weather [13]. Therefore, a technology that provides a sustainable and reliable means for the post harvest storage of chickpea would be worth inventing. The present study reports findings that may prove to be beneficial in storage of chickpea for longer time. We have exploited the usefulness of seaweed known as plant growth promoter in post harvest of chickpea. We found that extracts of seaweeds could reduce germination, increased shelf life without altering the natural texture of chickpea.

Materials and Methods

Collection of seaweeds and preparation of cell free extracts

Two seaweeds Sargassum wightii and Ulva lectuca used in the present study were collected from the coast of Mangrol (21.1200° N, 70.1200° E), Junagadh District, Gujarat, India in last week of January, 2014. These were washed thoroughly with seawater to remove all the unwanted impurities including sediments, salts and macroscopic epiphytes. Samples were kept in an ice box during transportation. Samples were rinsed with sterile water and dried on Whatman 3MM blotting paper under shadow seven days followed by hot air oven for 24 h at 40°C. Dried seaweed samples were grounded to powder and 5 g powder was suspended in 500 ml of sterile phosphate buffered saline. Extract was allowed to settle down and supernatant was passed through four layers of muslin cloth. The extract was stored at low temperature and thawed before seed treatment.

Seed treatment with seaweed extracts and monitoring of germination

Chickpea seeds were soaked in aqueous extracts of S. wightii or U. lectuca for 6 h and dried at room temperature. These were sowed in soil around 0.5 cm deep and watered regularly. Control Chickpea seeds were soaked in sterile phosphate buffered saline. Seed germination was confirmed by observation of two primary leaves. For monitoring the effect of storage conditions on seed germination, the chickpea seeds were soaked in aqueous extracts of S. wightii or U. lectuca for 1 h and dried at room temperature. These seeds were kept for 10 days in room or -20°C deep freezer or 4-8°C refrigerator or open terrace in open petri-plates or in air tight plastic bag. Untreated seeds were also processed in parallel as control.

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*Corresponding author: Gaurav S Dave, Assistant Professor, Department of Biochemistry, Saurashtra University, Rajkot-360 005, Gujarat, India, Tel: 094-282-758-94; E-mail: gsdpsu@gmail.com/gsdave@sauuni.ernet.in

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found contradictory results on pretreatment of chickpea seeds with seaweed extract, stimulates dormancy/delay in germination and decrease germination percentage, before sowing in field. Seaweed contains various plant growth regulators i.e., Indole acetic acid, abscisic acid, gibberellin, Indole butyric acid [14]. Abscisic acid exhibits dormancy effect on seed in contrast to gibberellin and Indole acetic acid, growth promoting activity. We treated seaweed extract in autoclave at 121°C and 15 lbs, which may be responsible for loss of stability of growth promoting factors, IAA and IBA stability is vulnerable under autoclaving [17], gibberellins decomposes under autoclaving and produces inhibitory products [18] whereas, anti-germinating factors could be remained unaltered, leads to delayed/anti-germinating effect on chickpea seeds.

We found chickpeas stored at room temperature or on open terrace either in air tight bag or in open container showed spoilage and wrinkled texture ultimately decreased longevity in comparison to seeds stored at 4-8°C and -20°C temperature, our results are in support of earlier report regarding increasing temperature is responsible for high rate of loss of viability in chickpea seeds [19,20]. Moreover, seeds kept in open container showed darkness in color compared to seeds kept in air tight bag, whereas, least changes were found with the seeds stored at -20°C. These results indicate deleterious effect of high temperature and open container for storage of chickpeas.

In conclusion, autoclaved seaweed extract pretreatment to chickpea delays germination and temperature above 8°C and open container is not suitable for preservation of green chickpea irrespective of seaweed extract treatment.

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