EFFECT OF SEED SPROUT EXTRACT OF SOME CROP SPECIES ON ORGANICALLY PRODUCED VEGETABLE TRANSPLANTS

By

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B. Sc. Agric. (Horticulture), Ain Shams University, 1998

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ABSTRACT

Faten Ibrahim Elsayed Ibrahim: Effect of Seed Sprout Extract of Some Crop Species on Organically Produced Vegetable Transplants. Unpublished M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2014.

Nowadays organic vegetable production in Egypt increase demand for organically grown transplants. Peat moss is a major source of organic matter used in formulation transplants growth media, but it's poor in plant nutrients. Therefore, a number of soluble organic fertilizers and supplements have emerged in the market but unfortunately, these products are usually expensive and not always locally available. Plant extract were recently used and appeared to be promising natural fertilizers and bio-fungicides.

Recent research showed that the sprouting improve the nutritional quality of seeds. Fenugreek and rocket sprout showed increment in amino acids, vitamins, antioxidants, some minerals (K, P, Fe, Ca and Mg), micronutrients and other bioactive compounds compared with their seeds. Moreover, fenugreek seeds powder and henna dry leave powder are evaluated as a sanitizer on tomato and cucumber transplants growing media. However, from these preliminary experiments, it was recommend replacing chemical fungicide by adding fenugreek seed powder at 5% and henna dry leaves powder at 0.2% for tomato and cucumber transplanting growing media respectively as bio-fungicides substitute.

The purpose of this study was to evaluate the incorporation of fenugreek and rocket sprouts powder-based medium amendment and water extract as foliar spraying for organic tomato and cucumber transplant production. Growing medium of 1 peat: 1 vermiculite (by volume) was amended with 0%, 0.2%, 0.4% or 0.6% weight by weight of each fenugreek or rocket sprout powder-based organic amendment in both tomato and cucumber transplants production experiments. Transplants length, shoot fresh and dry weight and root dry weight were measured. Relative to growth in medium with no amendments (control), transplants growing in the

amended medium had increased tomato and cucumber transplants growth characters.

However, the lowest concentration of rocket sprout emended media recorded the highest tomato transplant length, shoot and root weight, while in cucumber transplants the highest values of growth characters were obtained with the highest concentration of rocket sprout amended media.

Tomato and cucumber transplants growth response depended on the sprout water extract source and extract concentrations (0.0%, 0.1%, 1% or 10%). Tomato transplants recorded the higher shoot length and shoot and root dry weight by undiluted fresh rocket sprout extract (10%) when sprayed on tomato transplants twice a week. On the other hand, cucumber transplants recorded the higher growth characters by diluted dry fenugreek sprout extract (0.1%) when sprayed on cucumber transplants twice a week.

Combination between media amended with best rocket sprout powder concentration and best sprout (fenugreek or rocket) foliar spray treatments recorded significantly an increment in both tomato and cucumber transplants shoot length, shoot fresh and dry weight and root dry weight, leaf area, chlorophyll SPAD values.

The stimulatory effects by water extracts and powder amended from seed sprouts suggested that fenugreek and rocket sprout tissue may contain water soluble compounds that exert stimulatory effect on the growth of tomato and cucumber transplants produced under greenhouse conditions resulting in produced organic transplants with suitable growth characteristics and met commercially acceptable standards for transplants of both crops.

Keywords: organic, vegetable, transplants, plant nutrition, sanitizer, media amendment, foliar spraying, sprouts, powder, extract, tomato, cucumber, henna, fenugreek, rocket.

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I. INTRODUCTION

Production of organically grown vegetables has become increasing popular. In such a system, most vegetable crops are established from greenhouse grown transplants to optimize the production system. Transplant production is a critical phase that significantly affects growth and development of the crops in the field **(Dufault, 1998).**

Organic production of vegetable transplants requires the use of media that meet the requirements of the National Organic Standard. Production of transplants in small cell trays in peat-based medium is the most common and widely practiced method **(Raviv *et al.*, 1986).**

There is little information available on aspects such as nutrient management in organic transplant production; as a result, organically produced transplants are often of low quality **(Díaz-Pérez *et al.*, 2008).**

With increase in demand for organically grown transplants, a number of soluble organic fertilizers and supplements have emerged in the market. These products are usually expensive and not always locally available. As a result of limited commercial availability of certified vegetable transplants, most growers produce their transplants on farm **(Abdallah, *et al*., 2000).**

Because peat moss is poor in plant nutrients, supplementing peat-based medium with a standardized organic amendment serves as viable alternative for nutrient management in organic transplant production. Using organic amendment not only supplies plant nutrients but also increases tolerance and resistant to disease, retains medium moisture, and ensures quality transplants produced (**Gagnon and Berrouard, 1994).**

INTRODUCTION

The objective of this study were to determine the effects of fenugreek and rocket sprout powder-based medium amendment and foliar spraying of different sprout extracts on tomato and cucumber transplants production. The study hypothesis was that supplying nutrients from different sources of seed sprouts would affect the production of tomato and cucumber transplants.

II. REVIEW OF LITERATURE

Organic transplants production is the main challenge for vegetable production organically in most of developing countries. In order to have a wide view of this respect, the collected literature will be reviewed under the items of sanitation of transplants growing media and seed sprouts effect on transplants production.

2.1. Sanitation of transplants growing media:

Synthetic fungicides, despite their high efficacy, have always been subjected to studies seeking to replace them by some other methods of control pathogen, because of their detrimental effect to the environment. Due to their high residual effect, they have also entered the food chain of the ecosystem, thereby also affecting human health. Thus, workers have carried out various experiments to find natural alternatives, which include systemic induced resistance, biological control, genetic engineering or use of easily degradable plant products. They are more acceptable in society as they have no residual effect and are easily biodegradable **(Singh *et al.*, 2010).** A multitude of plant compounds is readily available over-the-counter from herbal suppliers. Plants have an almost limitless ability to synthesize via aromatic substances, most of which are phenols or their oxygen-substituted derivatives. Useful antimicrobial phytochemicals can be divided into several categories **(Cowan, 1999).** Differential antimicrobial activity of herbs against different bacteria might be due to present of different active phyto-compounds. Among those antimicrobial compounds, phenolic compounds, terpenoids, and alkaloids (**Das *et al*., 2012)**.

The antimicrobial properties of plant extracts from various species have been proven to affect fungal development *in vitro* and *in vivo* **(Bautista-Banos *et al.*, 2003).** Many crop species have antimicrobial effect whenever

incorporated into transplants grown media. Our study concerns the sanitizing effect of fenugreek seeds and henna leaves.

2.1.1. Effect of fenugreek seed

Fenugreek seed contain many compounds such as saponines, coumarin, fenugreekine, nicotinic acid, sapogenins, phytic acid and trigonelline, which are thought to account for many of its presumed therapeutic effects **(Puri, 1998)**. Saponins are one important class of plant secondary metabolites, which are connected to the plant's natural defense system **(Andresen and Cedergreen, 2010)**. Polyphenolic content of endosperm and seed coat of germinated fenugreek seeds decreased when compared to endosperm and seed coat of ungerminated fenugreek seeds (**Shakuntala *et al.*, 2011**). Plant phenolics have been found its properties in reducing several diseases and also to inhibit the *in vitro* growth of several of fungal species **(Baranowski *et al.* 1980** and **Bravo, 1998). Kanan and Al-Najar (2008)** Showed that fenugreek fractions rich in alkaloids, as well as phenolic compounds reduced activity of blue mold on citrus fruits. In another investigation, it was found that all fenugreek plant parts showed antifungal potential and the magnitude of their inhibitory effects are species and plant parts dependent **(Haouala *et al.* 2008). Sulieman *et al.* (2008)** indicated that fenugreek seed oil has a potent antimicrobial activity against all tested microorganisms which are three bacteria species of *Escherichiacoli*, *Staphylococcus aureus*, and *Salmonella typhimurium* and one mould is *Aspergillus niger*. **Das *et al*. (2012)** stated that aqueous extract of fenugreek showed synergistic activity against *Proteus vulgaris* and additive effects against *Staphylococcus aureus, Bacillus cereus* and *Aspergillus niger* because of some of the known active constituents like trigonelline alkaloid of fenugreek. Aqueous extract of fenugreek indicated higher anti-microbial activity showing greater diameter of inhibition zones.

Zia (2003) results indicated that fenugreek amendment is not only associated with changes in the fungal community structure in the soil and rhizosphere, but also with changes in the fungal community within the plant tissue. This strongly suggests that the physiology of a plant growing in fenugreek amended soil is different from one grown in the absence of fenugreek. He also found that soil amendments with powdered decomposed seeds of fenugreek and aqueous extracts enhanced plant height and fresh weights of shoot. In general, fenugreek-mediated impact on growth of mungbean plant. Saponin-containing plants can be growth-enhancing and fungicidal effects. The stimulatory plant physiological effects can be used in agriculture and horticulture together with the documented fungicidal effect to enhance crop yield and quality (**Andresen and Cedergreen, 2010**). The same scientist investigated the growth regulatory effect of tea seed powder (TSP) saponin-rich as a soil and spray application on growth of pot grown beet, mustard, oat, barley and strawberry. The results concluded that TSP has pronounced and direct physiological effects on plants, which can both increase and decrease growth and yield depending on the applied dose. The growth-enhancing effect could be used commercially to improve crop yield.

2.1.2. Effect of henna leaves

Henna - *Lawsonia inermis* belongs to family Lythraceace. It is an extensively branched glabrous shrub and a habitat of North Africa and South West Asia. Now the plant is widely cultivated throughout the tropics for its leaves. Henna can be found on the nails of Egyptian mummies and is one of the oldest cosmetics still in use **(Brahmeshwari *et al.*, 2012)**. The essential phytochemical in henna leaves is lawsone (2-Hydroxy-1,4-naphthoquinone). Triterpenoids as Oleanaldehyde, Lupanaldehyde, Betulinic acid, Oleanolic acid, Betulin. Aromatics as Benzophenone, Benzaldehyde, *p*-hydroxycinamic acid. Sesquiterpene as Vomifoliol. Naphthoquinone as 2-methoxynaphthoquinone. Steroids as β-sitosterol, β-sitoglucoside. Others phytochemicals as 3-methylnonacosan-1-ol, Gallic Acid, D-Mannitol,

Behenic acid, Arachideic acid, Stearic acid, Lacoumarin, Lupeol, Cosmosiin, Luteolin, Acacetine, Fraxetin, Scopoletin, Esculetin, Stigmasterol, Lawsoniaside, Laloiside, Apigenin **(Kardar, 2005).** Phytochemical screening and analysis was carried out from henna leaf samples by **Saadabi (2007)** and showed high concentration of Mannite, Tannic acid, Gallic acid, Naphtaquinone (hennotannic acid), Crysophanic acid, Anthraquinones and Mucilage.

Henna is reported as antifungal **(Kardar, 2005 and Brahmeshwari *et al.*, 2012)**, Antimicrobial in general **(Guerrier *et al.*, 1988 and Das *et al.*, 2012),** enzymes inhibitory **(Yogisha *et al.*, 2002 and Kardar, 2005)** and cytotoxic activity **(Kardar, 2005). Abu-Zaed (2000)** reported that henna leaf contain different glycoside substances, the major material is Lawsone which have biological effect proven ability to resist mold and bacteria growth. **Al-Moajel (2004)** stated that the beneficial effect of henna on plant traits could be responsible for allowing them to grow without pathogenic stresses. This in turn, was reflected in positive and promotive influence on different plants parameters. **Pramod *et al*. (2007)** remarked that the extract of henna inhibited spore germination in *Colletotrichum gloeosporioides* and *Botryodiploida theobromae* by 94 and 70%, respectively. **Vivek and Jyoti (2007)** reported that aqueous leaf extract at 2% recorded 63% inhibition against *Alternaria lini* fungi. **Berenji *et al.* (2010)** demonstrated that henna has antifungal activity against *Malassezia.* In addition aqueous extract is more effective on *Malassezia* than methanolic and chloroformic extracts. **Brahmeshwari *et al.* (2012)** found that most of the compounds naphthothiazoles of Lawsone against *Curvularia lunata* and *Fusarium oxysporum* and have fungicidal activity. Different concentrations of the test compounds were scored to calculate the percentage of inhibition of spore germination and the remaining compounds showed moderate activity against the fungi tested. **Das *et al*. (2012)** showed that spices like cumin, fenugreek or henna worked very well as resistant to different anti-microbial agents. Henna aqueous extract was more effective than their ethanolic extracts. Henna have potentially higher antimicrobial efficacy especially on fungus. **Zumrutdal and Ozaslan (2012)**