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Preliminary Report on Multiple Harvests of Microgreens from Chickpea (*Cicer arietinum*) Seeds

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ABSTRACT

Microgreens are edible baby plants with huge potential for leafy vegetable production and many consider this plant-based functional food as the new "Superfood". Microgreens have many advantages over sprouts and they help to improve the nutritional value of our diet, with their high content of healthy compounds. During the microgreen cultivation, seeding is usually done as a broadcast or in rows and as the seeding density is difficult to recommend, most growers prefer to seed as thickly as possible to maximize production, but not too thickly because crowding encourages elongated stems which increases the risk of disease. Some growers have noticed the possibility of a "second harvest" of microgreens, just after the majority of tall-grown microgreens are carefully harvested from the substrate with very high density of seeds, leaving a certain percentage of ungerminated seeds and sprouts to develop further. The present study investigated the possibility of harvesting more than one microgreen crop from a set of chickpea seeds through the regeneration of shoots after the first and the successive cuts above the lowest nodal portion of the shoots. It also included a study on the growth characteristics of the microgreens after the successive harvests.

KEYWORDS: *Microgreens, Leafy vegetables, Chickpeas, Germination and Regeneration, Multiple harvests*

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INTRODUCTION

Microgreens, the popularly known "new Superfood", are immature edible vegetables which include seedlings of vegetables, herbs or other plants and also acquired immense potential for adapting leafy vegetable production to a micro-scale level and to improve the nutritional value our diet (Kyriacou et al, 2016; Turner et al, 2020).Common microgreens cultivated worldwide include amaranth, basil, beet, cabbage, celery, chervil, Chinese kale, cilantro, fennel, garden cress, mustard, parsley, radish, rocket or arugula, snow pea, sorrel, and Swiss chard (Ebert, 2012). Their normal size is between a sprout and a well-grown seedling and are harvested anywhere from a week to two weeks after germination with two fully developed cotyledons and a pair of partially developed true leaves.

Microgreens are often grown indoors, in greenhouses or other protective structures or at home on a window ledge, on a porch or balcony and even on a shelf in the kitchen, without the use of fertilizer or of any spraying, providing adequate temperature, ventilation and light (Di Gioia et al, 2019). In addition, the growing cycle is also short, from 7-14 days for most microgreens and a grower can easily produce more crops in a month's time. During their cultivation, seeding is usually done as a broadcast or in rows and as the seeding density is difficult to recommend, most growers prefer to seed as thickly as possible to maximize production, but not too thickly because crowding encourages elongated stems and increases the risk of disease (Mir et al, 2017; Murphy and Pill, 2010).

Microgreens are harvested close to the stem base with simple harvesting tools so as to avoid contaminating the final product with growing substrates or seeds. Some growers have noticed the possibility of a "second harvest" of microgreens, just after the majority of tall-grown microgreens are carefully harvested from the mat having very high density of seeds, allowing a certain percentage of ungerminated seeds and sprouts to develop further. Though there are a few research articles on the effects of various seed treatments on seed germination percentage and plant biomass of microgreens (Lee et al, 2004), similar scientific studies have not been reported so far in any crop species, on the performance of shoots re-grown from the basal portions of the seedlings when they were left untouched, after the harvest of microgreens. Hence, this study was undertaken to investigate whether the microgreens could be regenerated from a set of Chickpea (*Cicer arietinum*) seeds after the first and the successive cuts above the level of any one of the lowest nodes on the erect shoots. The selection of species for the current study was based on the occurrence of small growing buds at the base of the scale leaves and other growing points (nodes) on aerial plant parts of the Chickpea (*Cicer arietinum*) seedlings. During this work, the author has recorded the performance of the regenerated shoots and compared with that of the first shoots originated from the seeds. The article has also attempted to highlight the advantages of this harvesting method as compared to the existing system.

MATERIALS AND METHODS

Experiments on microgreen cultivation were conducted during the month of March, 2020 in a soilless system consisting of shallow plastic trays (measuring 20cmX12cmX3cm) with drainage holes, using fresh tissue papers (two layers) as substrates and seeds of Chickpea (*Cicer arietinum*) obtained from VFPCK, Kannur, soaked overnight before sowing. The germinated seeds were counted by the emergence of 2 mm radicle at the time of observation. Germination/Regeneration percentage (GP/RP) was calculated at germination and at the various stages of re-growth, using the formula:

(GP or RP %) = g×100/30; Where 'g' is the number of germinated seeds/regenerated shoots and 30 is the total number of seeds.

Harvests were carried out by cutting the shoots a few millimetres above the growing mat surface using a pair of clean scissors. Growth parameters were estimated at the time of harvests which includes the measurement of the shoot length. The fresh weight and dry weight of the shoots were measured using an electronic balance.

RESULTS AND DISCUSSION

The observations on seed germination, growth and development of Chickpea (*Cicer arietinum*) microgreens, are summarized below:

1. Germination and regeneration:

The seed germination rate was found to be very high for Chickpea (*Cicer arietinum*) and as shown in Fig.1, active regeneration of shoots was observed with the germinating seeds, when they were allowed to re-grow after the cut above any one of the lowest nodes on the erect shoots. This could be repeated from the same set of seeds after the second and the successive harvests also.

2. Shoot length & Biomass:

The changes in shoot length and other growth parameters of Chickpea (*Cicer arietinum*) microgreens recorded during the first to the fourth harvesting stages are presented in Table 1. The shoots appeared to be green and healthy, but their length and biomass were found to be reduced gradually during all the four re-growing attempts.

Fig.1: Chickpea microgreens a) Harvested crop; b) & c) stages showing regeneration of shoots after the first harvest

Harvest	Germination/ Regeneration (%)	Shoot length(cm)	Fresh weight(g)	Dry weight (g)
First	98.00	8.34	0.165	0.034
Second	95.60	7.90	0.158	0.029
Third	81.50	7.25	0.146	0.024
Fourth	74.15	6.80	0.104	0.018

Table 1: Growth parameters of Chickpea (Cicer arietinum) microgreens during the multiple harvesting stages

CONCLUSION

Growing microgreens is an affordable and sustainable cultivation practice and it offers a promising approach to increase the production of leafy vegetables without causing damages to the supporting ecosystems. By identifying and working on a model crop species, the author attempted to introduce the multiple harvesting method hitherto unexplored by the growers of microgreens, with the following characteristics:

1. It helps the grower to produce a steady supply of crops without succession planting
2. No requirements for any special care or treatment
3. It saves the quantity of seeds, substrates, etc. required for growing a number of crops
4. It reduces the quantity of wastes generated from the operations involved growing and harvesting several crops
5. It reduces the overall expenditure involved in the cultivation

This preliminary work on growing and re-growing of Chickpea (*Cicer arietinum*) microgreens showed that this rare system of re-growth and harvest needs to be explored in order to establish its potential to permit more efficient use of the expensive greenhouse space. This technique is also expected to help in microgreen production in special growing environments such as high altitude cultivations, space life support systems, etc. However, the author feels

that the success of this multiple-cut method relies on identifying the suitable species and also on further studies on selecting the suitable method to eliminate the fungal contamination and also on improving and optimizing the regeneration steps involved including the fertigation requirements, before introducing it as promising option to assure the delivery of high quality crops at lower production costs.

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