



Varietal Screening and Maturity Stage Evaluation of Corn (*Zea mays* L.) Microgreens Through Sensory and Acceptability Study as Potential Food in Southern Philippines

Mark Al-jamie J. Muttulani¹, Lorelyn Joy N. Turnos-Milagrosa¹, Leila S. Moscoso²

10.18805/ajdfr.DRF-467

ABSTRACT

Background: Microgreens is defined as young seedlings of edible vegetables and herbs which are used to add spiciness and sweetness to foods. In the market it is usually products of certain herb and vegetable species; but there were limited published research study that corn is grown as Microgreens especially in the Philippines. This significantly aims to test the acceptability of corn varieties of University of Southern Mindanao Philippines as potential food for microgreens.

Methods: A study was conducted to explore the potential of corn microgreens as culinary ingredient, to assess consumers' acceptability on different varieties of corn to be prepared as microgreens and to evaluate specific harvesting stage and light response which are ideal in microgreen production. In study 1, response of six corn varieties produced in Southern Philippines were tested, namely: 'Sweet' corn and glutinous corn as the commercial checks and four USM varieties (USM vars 6, 10 and 24 and USMARC NCH-33). For study 2, different harvesting stages of "Sweet Corn" seed subjected to light and without light responses were evaluated at 6 and 8 days after sowing (DAS).

Result: Results of the sensory evaluation revealed high consumers' acceptability on the three USM varieties, namely: USM Vars 6, 10 and 24 and Sweet Corn which were harvested at 6 DAS with or without light exposure. With these, it can be concluded that corn seeds can also be grown and produced as microgreen products aside from its benefit as staple crop.

Key words: Corn microgreens varieties, General acceptability, Harvesting stages, Sensory evaluation.

INTRODUCTION

Corn is crop rich of beneficial phytochemicals including fiber, phenolic acids, flavonoids, carotenoids and resistant starch that are complementary to those in grains, fruits and vegetables (Liu, 2004). Currently, microgreens gather high potential when it comes to enhancing nutritional value that fits for human consumption, considering its high nutritional compounds. Aside from the organoleptic traits which microgreens contain, they become more interesting and popular for their nutritional value and huge commercial potential since they require minimal production requirements; hence, attaining their maximum consumption within a relatively short period of time. Moreover, Chouvan *et al.* (2017) also stated that corn characters might also contribute to the yield and physicochemical traits of the corn plants such as TSS.

Different characteristics were observed in this type of vegetables as compared to common sprouts and mature leafy vegetables (Kyriacou *et al.*, 2016; Lenzi *et al.*, 2019). Microgreens are rich in bioactive compounds and nutritional benefits such as vitamins, minerals and phytochemicals, moreover, they also act as antioxidants with the ability to prevent cell damage. With its significant contents and micronutrients, this type of crop is emerging and gaining interest as potential food with many health benefits. In addition, they are also gaining popularity due to their acceptable textures, colors and flavors (Renna *et al.*, 2017). Microgreens have wide range of species and

¹Department of Crop Science, University of Southern Mindanao, Kabacan Cotabato, 9407, Philippines.

²Department of Food, Nutrition and Dietetics, University of Southern Mindanao, Kabacan, Cotabato, 9407, Philippines.

Corresponding Author: Mark Al-jamie J. Muttulani, Department of Crop Science, University of Southern Mindanao, Kabacan Cotabato, 9407, Philippines. Email: majmmuttulani@usm.edu.ph

How to cite this article: Mark Al-jamie J. Muttulani, Turnos-Milagrosa, L.J.N. and Moscoso, L.S. (2025). Varietal Screening and Maturity Stage Evaluation of Corn (*Zea mays* L.) Microgreens Through Sensory and Acceptability Study as Potential Food in Southern Philippines. Asian Journal of Dairy and Food Research. 44(3): 404-411. doi: 10.18805/ajdfr.DRF-467.

Submitted: 07-10-2024 **Accepted:** 19-11-2024 **Online:** 03-02-2025

varieties to be grown and their growing condition has the possibility to control even in small to micro-scale production which has significant potential as source of good nutrition, as well as to address consumers demand particularly on vegetable consumers, enthusiast or vegans (Renna *et al.*, 2018). Growing microgreens does not need much space, one of the benefits of growing this crop is simply just adaptable and suitable for urban agriculture that supports space life system (Kyriacou *et al.*, 2016).

Corn is considered as the mother grain of an American people that is deemed to be the first cultivar in the world which is an annual crop that belongs to the grass family

also known as *Poaceae* family. It is one of the major popular cereals in the world and forms the staple food source in many countries (Solanke *et al.*, 2022). There is an annual type of crop that requires suitable apprehension, warm weather conditions and good management. It is also valuable to human food, animal feed and a raw material needed by several industries. Potential usage of corn, growing of immature green leafy vegetables consisting of approximate 2 inches height with young succulent stems of first set of true leaves called as microgreens has become a promising food of the 20th century. The conventional corn microgreens were harvested without the root at approximately one month after seed emergence. Microgreens differ from baby greens in their sizes wherein baby greens are smaller. Petite greens or vegetable confetti refer to the sprouts that are larger than the range size (Anonymous, 2013), which are usually harvested later than the sprouts (Anonymous, 2014; Millard, 2014). According to Oh *et al.*, 2010, microgreens of Lettuce (*Lactuca sativa*) contain higher phenolic concentration and total antioxidant capacity than the mature leaves. Microgreens can be used as an ingredient in wide varieties cuisine, including sandwiches, soups and salad, enhancing the flavor, color and texture which can be used as edible garnish for plating of dishes that enhances food color and brighten a wide variety of main dishes (Murphy *et al.*, 2010; Treadwell *et al.*, 2010; Lee *et al.*, 2009; Lee *et al.*, 2004). Although micro-greens have been declared with many nutritionally beneficial, there is still limited scientific information available as to its accurate phytochemical content analysis. Some studies have shown that some young growth seedlings have higher vitamins, minerals and other health-giving phytonutrients than the older and mature leaves (Choe *et al.*, 2018). Microscale vegetables are now becoming popular for home-made food preparations subjected to various food preparation testing with higher interest in producing ready-to-eat market including the industry of dietary supplements. Microgreen products are agricultural by-product innovations that hold a vast potential for sustaining and diversifying the

agriculture industry contributing to demographic development, economic growth, environmental preservation and improvement of human health. Corn microgreens are one of the potential food crops which are edible, tasty and extremely healthy containing health promoting compounds depending on the variety. However, as of the moment, there is still a limited availability of research findings on microgreens, hence exploring the potential of corn as microgreen product is of high importance. Therefore, a study on the potential of corn as microgreens was done. Data of this research were gathered through a sensory evaluation test were ideal corn varieties and harvesting stages of corn microgreens produced in University of Southern Mindanao, Philippines were evaluated. Moreover, unveiling the potential usage of this crop as vegetable microgreens can help future researchers and corn microgreens enthusiasts to optimize its further utilization for potential commercialization and product development.

MATERIALS AND METHODS

The sensory evaluation experiment was conducted at the College of Human Ecology and Food Sciences, University of Southern Mindanao, Kabacan, North Cotabato, Philippines from January to December 2023, with an average temperature ranging from 22 to 35°C throughout the duration of the study. Matured corn seeds used in the experiment were procured from the University of Southern Mindanao, Corn Research Center and carefully selected and sorted according to the following criteria (undamaged, disease-free and matured seeds). Seeds of different varieties were immediately soaked in distilled water for eight hours to soften the hard shells and kick-start the germination process. After soaking, seeds were immediately planted in a 1020 flat seedling trays with no hole filled with sterilized soil medium (coco peat). Sterilization of soil substrates was subjected to boiling water treatment. Growing of corn microgreens was conducted at Horticulture Laboratory room, College of Agriculture, University of Southern Mindanao, Philippines (Fig 1).



Fig 1: Actual experimental set-up of corn microgreens in growing trays at Horticulture Laboratory Room, College of Agriculture, University of Southern Mindanao, Philippines (Component study 2).

The experimental set-ups were carried out in a Completely Randomized Design (CRD) with five treatments replicated four times, with 500 seeds per experimental unit. Corn varieties which were evaluated were: Sweet Corn, Glutinous Corn and USM developed corn varieties including, USM Var 6, USM Var 24, USM Var 10 and USMARC NCH 33 (Fig 2). Different harvesting stages and light responses of sweet corn microgreens were also evaluated with the following treatments: 6 and 8 days after seed sowing with cover; 6 and 8 days after seed sowing with cover.

Corn microgreens were harvested using a sterilized food scissor by simply cutting 2 cm at the base of the seedling upon the time of harvest (Fig 3). Harvested microgreens were prepared and subjected to sensory evaluation using fried lumpia as food preparation for testing (Fig 4). Sensory evaluation was conducted at the Sensory

laboratory room of the College of Human Ecology and Food Sciences (CHEFS), University of Southern Mindanao (Fig 5). There were thirty (30) respondents invited as panel of evaluators, consisting of 15 male and 15 female (3 panel experts, 7 panel with knowledge on sensory evaluation test and 5 panel microgreens enthusiast/consumers per gender category), ages from 18-65 years of age which are legally considered adults. Equal distribution of panels by age and gender were done for more accuracy of the data. The level of significance was set at 5% and significant differences were analyzed using Friedman Test.

RESULTS AND DISCUSSION

Corn varietal screening

Table 1 shows the screening of corn microgreen varieties used as one of the ingredients for fried lumpia (a traditional

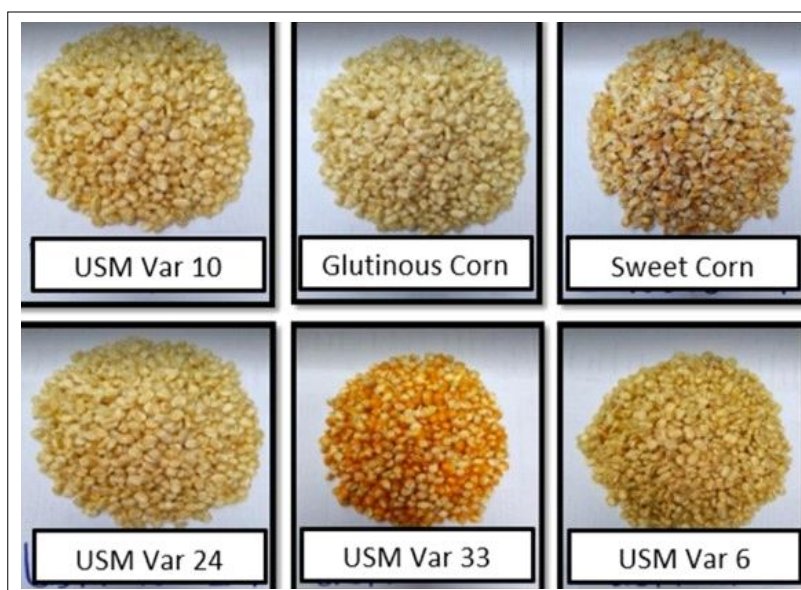


Fig 2: Corn seed varieties (USM Var 10, Glutinous corn, Sweet Corn, USM Var 24, USM Var 33 and USM Var 6) used for component study 1.

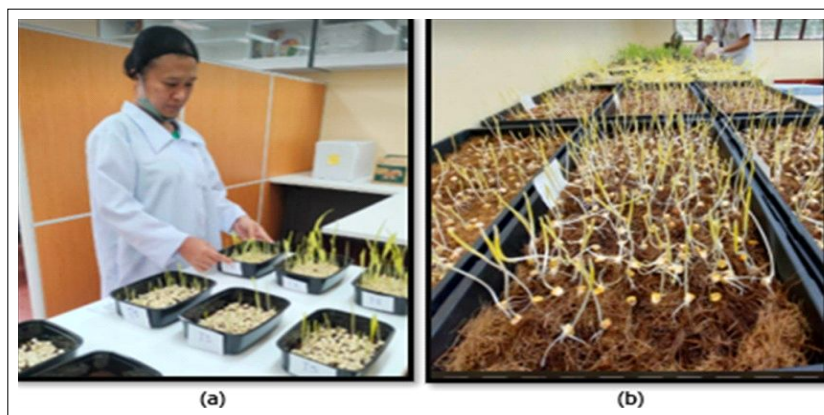


Fig 3: Harvesting of sprouted corn microgreens used for component study 1(a), Germinated corn microgreens used for component study 2.

Filipino dish). Significant differences were observed among the different sensory data parameters evaluated based on their appearance, taste and general acceptability. Sweet corn (4.57) and USM var 10 (4.03) were verbally described as with “most distinct corn aroma”. It was also observed that Sweet corn, USM var 6, USM Var 24, USM Var 10 and USMARC NCH 33 had comparable results having medium to coarse texture of harvested microgreens. In terms of the general acceptability, significant and comparable results were observed to Sweet corn (6.34), USM Var 6 (6.30), USM Var 24 (6.27), USM Var 10 (6.23) and USMARC NCH 33 (5.90) corn microgreens which described as “like strongly”. Moreover, no significant difference was observed in terms of the appearance and taste of corn microgreen varieties. Results revealed that the commercially available corn variety (Sweet corn), had comparable results with USM var 6, 24 and 10 in terms of general acceptability parameter. Therefore, these corn varieties can be used as vegetable microgreens which can be served as a new ingredient in fried lumpia and other potential food preparations such as

salad, soups, sandwiches and enhancing food color, texture and/or flavor and can be used as edible garnish to brighten up a wide variety of main dishes (Murphy *et al.*, 2010; Treadwell *et al.*, 2010; Lee *et al.*, 2009; Lee *et al.*, 2004). In addition, Riggio *et al.*, (2019) stated that the use of a different variety of microgreens species can add to sense of taste and visual appeal to a dish. Moreover, it also influenced high market value and short harvesting period of microgreens make it a more valuable environment agri-crop (Wood, 2019).

Harvesting stages and light responses

The response of corn microgreens harvested at different maturity stages and light responses were presented in Table 2. Analysis of variance showed significant differences among the appearance, texture and general acceptability. As to the general acceptability parameter, corn harvested at 6 and 8 days after sowing (DAS) with cover (6.06 and 6.23) were general described as “like strongly”. In terms of the exposure of corn microgreens to light, microgreen

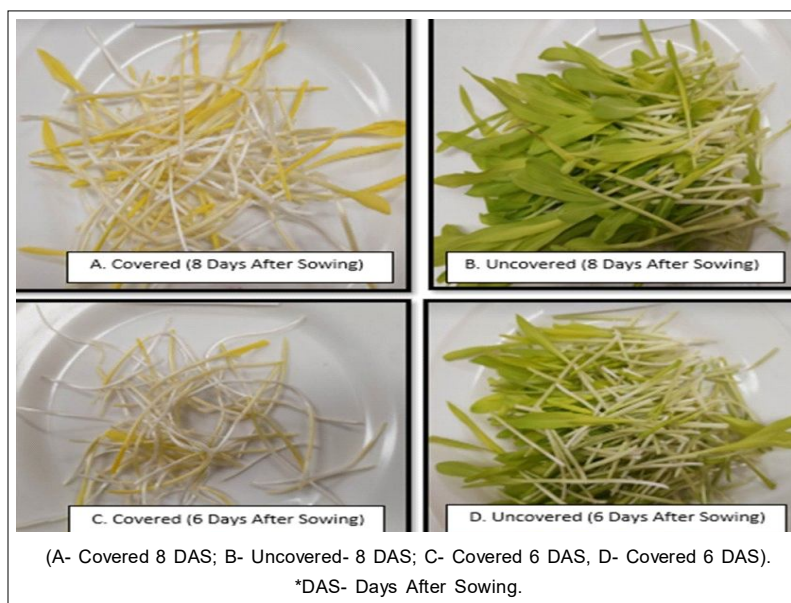


Fig 4: Harvested corn microgreens of different harvesting stages and light responses.

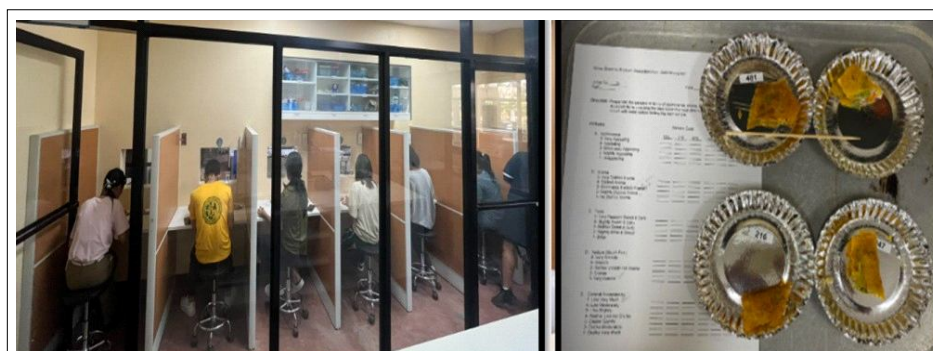


Fig 5: Sensory evaluation conducted at the Sensory Laboratory Room of College of Human Ecology and Food Sciences (CHEFS), University of Southern Mindanao, Philippines.

harvested at 6 days after sowing (DAS) with or without cover and at 8 days after sowing (DAS) with cover had attained “appealing” appearance and “moderately sweet taste”. The microgreens harvested at 8 DAS without cover resulted in “moderately appearance” with slightly bitter taste. Based on the general acceptability results, out of the four microgreen treatments, only microgreens harvested at 6 DAS with or without cover had comparable results having “like strongly” general acceptability. According to the Epic Gardening 2023, corn plants are famously fast growers, in less than a week, a handful hard kernels produced an abundance, healthy, delicious microgreens. It is also stated that at 6-8 days of growing corn shoot is the perfect time to harvest corn, since corn shoots will get more fibrous and bitter as they age.

The potential of corn microgreen varieties as vegetables has interesting quality traits that has been used to enrich the diet of specific group of demanding consumers (Kyriacou *et al.*, 2016). The production of microgreens became popular due to its intense flavor, crunchy texture and bright color that contains nutraceutical properties that promote health benefits to the consumers (Choe *et al.*, 2018; Carillo *et al.*, 2022). Growing sprouts and microgreens are so advantageous to the consumers, since it needs a short harvesting period and the maintenance is considerably lower compared to the mature green plants (Sharma *et al.*, 2020). Generally, raw microgreens sprouts contain more dietary fibers along with the stored phytochemical in plants that play a major role in improving human health (Aloo *et al.*, 2021). Similarly, as for microgreens, these are considered superfoods that can be produced particularly in semi-urban and urban settings in a limited space with a short growth cycle and a minimum to no use of external nutrients for growing (Di Bella *et al.*, 2020). Produced corn microgreens are grown in the presence of different kinds of growing medium and light response, resulting in fully developed leave that are believed to provide and supply requirements nutrients.

Results of this study revealed that different varieties and harvesting stages of corn microgreens had significant effects on the general acceptability of corn microgreens. Sweet Corn, USM var 6, 24 and 10 resulted in the most acceptable variety of corn microgreens. Moreover, data implied that corn microgreens harvested after sowing in an enclosed or covered condition generally resulted in the most acceptable stages of microgreens. These results provide quality traits of microgreens as potential vegetable for consumption since only limited studies have been conducted as to its general acceptability as food with the influenced of varieties, harvesting stages and light responses. Therefore, as one of the popular cereals in the world, the significant findings of the results can optimize the potential of corn as microgreen vegetable used in other culinary cuisines.

Interaction of genotype and age gave a significant result on energy, crude protein, crude fat and other nutritional

Table 1: Sensory evaluation test of different corn varieties as microgreens. University of Southern Mindanao, Kabacato, Philippines. 2023.

Treatments (Corn varieties)	Appearance ^{ns}	Aroma ^{**}	Taste ^{ns}	Texture ^{**}	General ^{**} acceptability
T1- Sweet corn	4.50	4.57 ^a	4.40	4.27 ^a	6.34 ^a
T2- Glutinous corn	4.23	3.90 ^b	4.03	3.53 ^b	5.70 ^b
T3- USM Var 6	4.33	3.90 ^b	3.77	3.83 ^a	6.30 ^a
T4- USM Var 24	4.40	3.73 ^b	3.77	3.83 ^a	6.27 ^a
T5- USM Var 10	4.20	4.03 ^a	4.13	3.77 ^a	6.23 ^a
T6- USMARC NCH 33	4.03	3.87 ^b	3.73	3.79 ^a	5.90 ^b
Ns-not significant.					
**. Significant.					
Rating scale and verbal description					
Appearance	Aroma	Taste	Texture Acceptability	General	
1- Unappealing (1.00-1.99)	1- No distinct aroma (1.00-1.99)	1-Extremely bitter (1.00-1.99)	1- Extremely Fine (1.00-1.99)	1- Dislike extremely (1.00-1.99)	
2- Slightly appealing (2.00-2.99)	2- Slightly distinct aroma (2.00-2.99)	2- Moderately bitter (2.00-2.99)	2- Fine (2.00-2.99)	2- Dislike moderately (2.00- 2.99)	
3- Moderately appealing (3.00-3.99)	3- Moderately distinct aroma (3.00-3.99)	3- Slightly sweet (3.00-3.99)	3- Medium (3.00-3.99)	3- Dislike slightly (3.00-3.99)	
4- Appealing (4.00-4.99)	4- Distinct a roma (4.00-4.99)	4- Moderately sweet (4.00-4.99)	4- Coarse (4.00-4.99)	4- Like slightly (4.00-4.99)	
5- Very Appealing (4.00-4.99)	5- Very Distinct Aroma (4.00-4.99)	5- Extremely sweet (5.00)	5- Extremely coarse (5.0)	5- Like moderately (5.00-5.99)	
				6- Like strongly (6.00-6.99)	
				7- Like extremely (7.0)	

Table 2: Sensory evaluation test of corn microgreens to different harvesting stages and light response. University of Southern Mindanao, Kabacan, Cotabato, Philippines. 2023.

Treatments (Harvesting stages and Light responses)	Appearance**	Aroma ^{ns}	Taste**	Texture ^{ns}	General** acceptability
T1- 6 days after sowing (with covered)	4.33 ^a	3.83	4.10 ^a	3.27	6.23 ^a
T2- 8 days after sowing (with covered)	4.30 ^a	4.00	4.00 ^a	3.53	5.87 ^b
T3- 6 days after Sowing (without covered)	4.03 ^a	3.83	4.03 ^a	3.83	6.07 ^a
T4- 8 days after sowing (without covered)	3.80 ^b	3.73	3.76 ^b	3.83	5.63 ^b
Ns-Not significant.					
**- Significant.					
Rating scale and verbal description.					
Appearance	Aroma	Taste	Texture acceptability	General	
1- Unappealing (1.00-1.99)	1- No distinct aroma (1.00-1.99)	1- Extremely bitter (1.00-1.99)	1- Extremely fine (1.00-1.99)	1- Dislike extremely (1.00-1.99)	
2- Slightly appealing (2.00-2.99)	2- Slightly distinct aroma (2.00-2.99)	2- Moderately bitter (2.00-2.99)	2- Fine (2.00-2.99)	2- Dislike moderately (2.00-2.99)	
3- Moderately appealing (3.00-3.99)	3- Moderately distinct aroma (3.00-3.99)	3- Slightly sweet (3.00-3.99)	3- Medium (3.00-3.99)	3- Dislike slightly (3.00-3.99)	
4- Appealing (4.00-4.99)	4- Distinct aroma (4.00-4.99)	4- Moderately sweet (4.00-4.99)	4- Coarse (4.00-4.99)	4- Like slightly (4.00-4.99)	
5- Very appealing (5.00)	5- Very Distinct Aroma (5.00)	5- Extremely sweet (5.0)	5- Extremely coarse (5.00-5.99)	5- Like moderately (5.00-5.99)	
				6- Like strongly (6.00-6.99)	
				7- Like extremely (7.0)	

benefits of corn (Indriani *et al.*, 2021). Known to its beneficial source, it can also escalate public health concerns and necessitate innovative approaches to food sources since it has gained recognition as nutrient rich functional food. As the population grows, innovative growing techniques of easily, accessible, reliable and nutritional dense supply of food is important. Among the urban agriculture approach, showing of interest in urban farming particular of its significant value under controlled environment is a rising technology approach that compasses vertical farms, greenhouses, hydroponics, aquaponic and growing microgreens (Benke, 2017). In terms on its economic potential aspects, growing microgreens can be a profitable enterprise which can help the economics of underprivileged communities in rural and urban areas afloat. With its current rising interest and demand, the global microgreens are expected to expand at a compound annual rate (Mordor 2021-2026; Report-Linker). As to its health benefits, microgreens have been subject of extensive scientific inquiry having rich in phytochemicals, minerals and high concentrations of vitamins. It also developed counterparts in terms of the amount of antioxidant and its content (Choe, 2018; Pinto 2015).

CONCLUSION

The results and findings of the study revealed that the acceptability of corn microgreens as a potential ingredient in culinary food was significantly affected by varieties, harvesting stage and light responses. Based on the varietal response, it was noted that the three corn varieties (USM Varieties 6, 24 and 10) developed by USM attained significantly comparable results with the commercially available "Sweet Corn" variety in terms of the texture and general acceptability of corn microgreens as food. Results also revealed that the sweeter taste and appealing appearance of corn microgreens were attained when microgreens are harvested six days after sowing, with or without cover. Result of these findings exploring corn microgreens as potential food source unlock opportunities for sustainable agriculture, improved nutrition and enhanced human well-being. Moreover, using these results can also be used as basis for future research opportunities particularly on nutritional analysis and profiling; bioactive compound identification and quantification; cultivation and processing optimization and economic and environmental impact assessments. Furthermore, it can also benefit key players such as researchers, academics, farmers, growers, food manufacturers and processors, regulatory agencies and health and wellness professionals that supports local agriculture with low environmental impacts, year-round availability and sustainable production corn microgreens in Southern Philippines.

ACKNOWLEDGEMENT

The present study was funded by University of Southern Mindanao under the futures thinking project supported by

University of Southern Mindanao Research, Development and Extension Services.

Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All sensory evaluation procedures for experiments were approved by the Research Ethics Review Committee by the University that measures the ethical fulfilment of research process or procedures.

Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

- Aloo, S.O., Ofosu, F.K., Kilonzi, S.M., Shabbir, U., Oh, D.H. (2021). Edible plant sprouts: Health benefits, trends and opportunities for novel exploration. *Nutrients*. 13: 2882. doi: 10.3390/nu13082882. [PMC free article] [PubMed] [CrossRef] [Google Scholar].
- Anonymous (2013). "MicroGreen Facts" (<http://www.freshorigins.com/microgreens.html>). Fresh Origins. Retrieved 2013-06-13.
- Anonymous (2014). "Contents speciality Greens Pack a Nutritional Punch" (<http://www.ars.usda.gov/is/AR/archieve/jan14/greens0114.htm>). USDA, Retrieved 23 January 2014.
- Chouvan, D., Maloo, R.S., Shingh, D. (2017). Studies on morphological and molecular diversity in speciality corn (*Zea mays* L.). *Indian Journal of Agricultural Research*. 51(2): 142-148. doi: 10.18805/ijare.v01of.7643.
- Benke, K.B.T. (2017). Future food-production systems: Vertical farming and controlled-environment agriculture, *Sustain. Sci. Pract. Policy* 13-26, <https://doi.org/10.1080/15487733.2017.1394054>.
- Carillo, P., El-Nakhel, C., De Micco, V., Giordano, M., Pannico, A., De Pascale, S., Graziani, G., Ritieni, A., Soteriou, G.A., Kyriacou, M.C. (2022). Morpho-metric and specialized metabolites modulation of parsley microgreens through selective LED wavebands. *Agronomy*. 12: 1502. doi: 10.3390/agronomy12071502.
- Choe, U., Yu, L., Wang, T.T.Y. (2018). The science behind microgreens as an exciting new food for the 21st Century. *J. Agric. Food Chem.* 66: 11519-11530.
- Di Bella, M.C., Niklas, A., Toscano, S., Picchi, V., Romano, D., Scalzo, R.L., Branca, F. (2020). Morphometric characteristics, polyphenols and ascorbic acid variation in *Brassica oleracea* L. novel foods: Sprouts, microgreens and baby Leaves. *Agronomy*. 10: 782. doi: 10.3390/agronomy10060782. [doi [Google Scholar][Ref list].
- Indriani, N.P., Yuwaraiah, Y., Ruswandi, D. (2021). The genotype and crop age effect on nutritive value of corn forage. *Indian Journal of Agricultural Research*. 55(3): 374-378. doi: 10.18805/IJARE.A-604.

- Kyriacou, M.C., Rouphael, Y., Di Gioia, F., Kyrtzlis, A., Serio, F., Renna, M., De Pascale, S., Santamaria, P. (2016). Micro-scale vegetable production and the rise of microgreens. *Trends Food Sci. Technology*. 57: 103-115.
- Lee, J.S., Kim, J.G., Park, S. (2009). Effects of chlorine wash on the quality and microbial population of 'Tah Tasai' Chinese cabbage (*Brassica campestris* var. *narinosa*) microgreen. *Korean J. Hortic. Sci.* 27: 625-630.
- Lee, J.S., Pill, W.G., Cobb, B.B., Olszewski, M. (2004). Seed treatments to advance greenhouse establishment of beet and chard microgreens. *J. Hortic. Sci. Biotechnol.* 79: 565-570.
- Lenzi, A., Orlandini, A., Bulgari, R., Ferrante, A., Bruschi, P. (2019). Antioxidant and mineral composition of three wild leafy species: A comparison between microgreens and Baby greens. *Foods*. 8(10): 487.
- Liu, R.H. (2004). Potential synergy of phytochemicals in cancer prevention: Mechanism of action *J. Nutr.* 134(12): 3479S-3485S.
- Millard, E. (2014). Indoor Kitchen Gardening: Turn Your Home into a Year -round vegetable garden (<https://books.google.com/books?id=GEf4AwAAQBAJandpg=PA63>). Cool Spring Press. P. 63, ISBN 978_1_61058_981_9. Retrived May 28.2017.
- Mordor Intelligence, Microgreens market-growth, Trends, Covid-19 Impact and Forecasts, (2021-2026), Available online: <https://www.mordorintelligence.com/industry-reports/microgreens-market>.
- Murphy, C.J., Pill, W.G. (2010). Cultural practices to speed the growth of microgreen arugula (roquette; *Eruca vesicaria* subsp. *sativa*). *J. Hortic. Sci. Biotechnol.* 85: 171-176.
- Oh, M.M., Carey, E.E., Rajashekhar, C.B. (2010). Regulated water deficits improve phytochemical concentration in lettuce. *Journal of American Society, Hortic. Sci.* 135: 223-229.
- Pinto, E., Almeida, A.A., Aguir, A.A., Ferreira, I.M.P. (2015). Comparison between the mineral profile and nitrate content of microgreens and mature lettuces. *J. Food Compos. Anal.* 37-43.
- Renna, M., Di Gioia, F., Leoni, B., Mininni, C., Santamaria, P. (2017). Culinary assessment of self-produced microgreens as basic ingredients in sweet and savory dishes. *J. Culin. Sci. Technol.* 15: 126-142. doi: 10.1080/15428052.2016.1225534. Report-Linker, Global microgreens market analysis and trends-industry forecast to 2028, Available online: https://www.reportlinker.com/p06127645/Global-Microgreens-Market-Analysis-Trends-Industry-Forecast-to.html?utm_source=GNW.
- Renna, M., Castellino, M., Leoni, B., Paradiso, V.M., Santamaria, P. (2018). Microgreens production with low potassium content for patients with impaired kidney function. *Nutrients*. 10: 675. doi: 10.3390/nu10060675.
- Riggio, G.M., Jones, S.L., Gibson, K.E. (2019). Risk of human pathogen internalization in leafy vegetables during lab-scale hydroponic cultivation. *Horticulturae*. 5(1): 25.
- Sharma, S., Dhingra, P., Koranne, S. (2020). Microgreens: Exciting new food for 21st Century. *Ecol. Environ. Conserv.* 26: S248-S251.
- Solanke, G.M., Singh, A.K. and Kadam, S.M. (2022). Studies on physical properties of different corn (*Zea mays*) varieties. *Asian Journal of Dairy and Food Research*. doi: 10.18805/ajdfr.DR-1991.
- Treadwell, D., Hochmuth, R., Landrum, L., Laughlin, W. (2010). Microgreens: A New Specialty Crop. University of Florida IFAS Extension. HS1164.
- Wood, L. (2019). Worldwide indoor farming market outlook 2019-2024-The decrease in cultivable land is driving growth. Research and Markets. <https://www.epicgardening.com/corn-microgreens/>.