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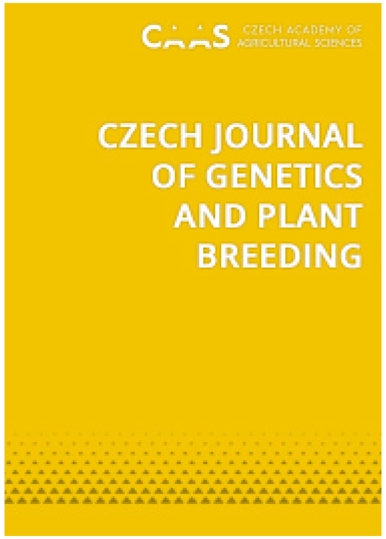

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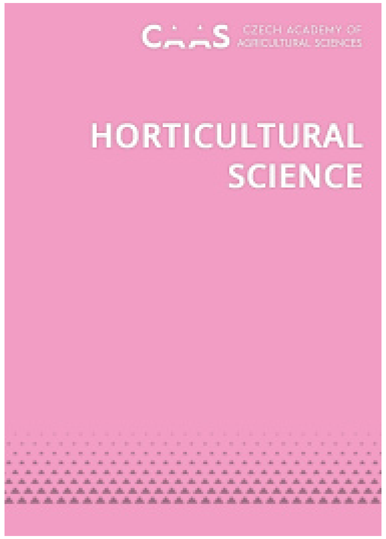

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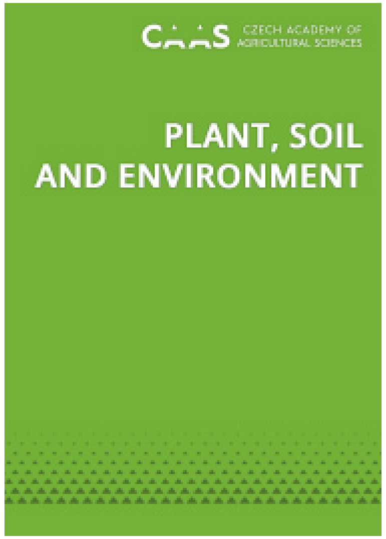
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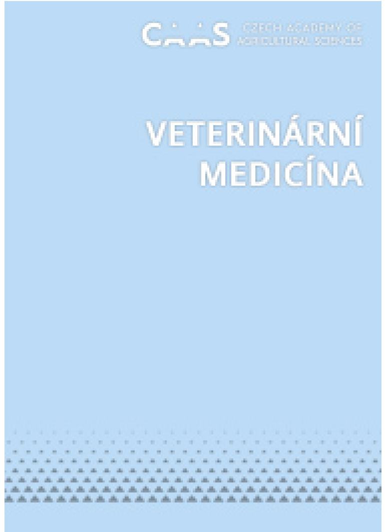

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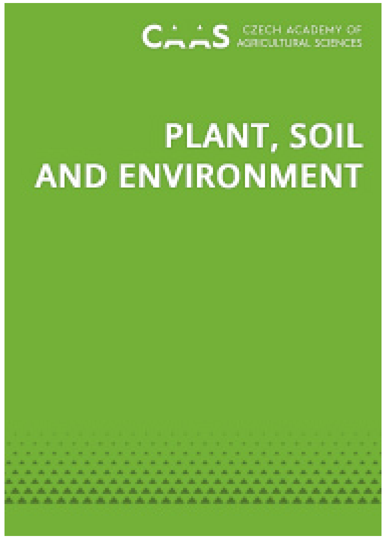

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Enhancing fruit quality of three *Physalis* sp. throughout foliar nutrition

Diana Nurus Sholehah[1,2], *Eko Setiawan*[2], *Dini Ermavitalini*[1,3], *Miratul Khasanah*[4], *Edy Setiti Wida Utami*[5], *Sucipto Hariyanto*[5], *Hery Purnobasuki*[5]*

[1]*Doctoral Study Program of Mathematics and Natural Science, Faculty of Science and Technology, Airlangga University, Surabaya, Indonesia*
[2]*Agroecotechnology Study Program, Agriculture Faculty, University of Trunojoyo Madura, Bangkalan, Indonesia*
[3]*Department of Biology, Faculty of Science and Data Analytics, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia*
[4]*Department of Chemistry, Faculty of Science and Technology, Airlangga University, Surabaya, Indonesia*
[5]*Department of Biology, Faculty of Science and Technology, Airlangga University, Surabaya, Indonesia*
**Corresponding author: hery-p@fst.unair.ac.id*

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Abstract: Foliar nutrients containing macronutrients, micronutrients and a combination of both were applied to *Physalis peruviana*, *P. alkekengi* and *P. ixocarpa* to determine their effect on fruit quality. A randomised complete block design study was conducted in a greenhouse on Madura Island, Indonesia. This study showed significant interactions between *Physalis* species and foliar nutrition to the physicochemical character of the fruit. Each species responded differently to the given nutrients. The combination of 1 g/L macronutrient (P and K) and 0.0625 g/L micronutrients (Zn, Fe, Cu, B, Mo and Mn) resulted in the highest fruit antioxidant activity, vitamin C, total soluble solids and redness of the three *Physalis* species. Generally, macronutrients and micronutrients in combination can be recommended to increase the quality of *Physalis* fruit.

Keywords: bioactive compound; fertilisation; goldenberry; marginal area; superfood

Soil infertility is a predominant factor in minimising production in tropical regions (Fiaz et al. 2021). Madura Island, Indonesia, has a high daily temperature, evaporation, salinity and a wide marginal area with low fertility. These constraints impede plant growth and production, including fruit quality, such as appearance, texture, taste and nutritional value (Jamaly et al. 2021).

In Indonesia, *Physalis* is commonly known as *ciplukan*. It is a wild plant that has been consumed as fresh fruit and traditional medicine (Iwansyah et al. 2020). *Physalis* originate from sub-tropical areas and have optimal growth at an altitude of 300–3 000 m a.s.l. and a temperature of 18–20 °C. Along with *Solanaceae*, such as *Lycopersicum*, *Solanum* and *Capsicum*, *Physalis* is a superfood with high economic value (Muniz et al. 2014). These plants are efficacious in overcoming hypertension, diabetes, bacterial infections, inflammation, liver disorders, impaired kidney function, cancer and immunity. *Physalis peruviana*, *P. ixocarpa* and *P. alkekengi* are edible fruits with high bioactive compounds, such

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as antioxidants and nutrients, including vitamins and minerals, compared to other *Physalis* species. In addition, *P. alkekengi* is an ornamental plant of this genus (Laczkó-Zöld et al. 2009, Shenstone et al. 2020). *P. peruviana* and *P. ixocarpa* can be processed into various products, such as sauces, jam, syrup and yoghurt (Muniz et al. 2014). The business opportunities of these fruits are still open widely by utilising the marginal area. However, cultivation in the marginal area requires techniques adapted to environmental conditions, such as fertilisation.

Foliar nutrition raises the utilisation rate of nutrients used and overcomes sudden nutrient deficiencies. The main challenge of foliar nutrition is determining the optimal dose to meet nutritional needs without causing leaf damage (Fallahi and Eichert 2013). Therefore, this study aimed to determine the effect of a foliar nutrient on the fruit quality of three *Physalis* species. This research contributes to science through effective fertilisation technology for the *Physalis* species to diversify food and improve nutrition for marginal land.

MATERIAL AND METHODS

Plant material and growth conditions. The study was conducted in a private greenhouse on Madura Island (latitude –7.247652°, longitude 112.449176°) at 5 m a.s.l. in May–August 2001. The average rainfall was 91.1, 31.5, 21.7 and 14.0 mm, and maximum temperatures were 35.8, 34.7, 33.5 and 33.7 °C, respectively. A plant was planted in polybags containing 10 kg of growing media consisting of Mediterranean soil, cow dung and husk charcoal (3:1:1). The characteristics of the media were pH 7.3, 2.40% organic carbon, 0.31% total Kjeldahl N, 14.40 mg P_{Olsen}/100 g, 14.33 mg K/100 g, 10.60 mg Fe/kg, 6.04 mg Mn/kg, 0.18 mg Cu/kg, 0.19 mg Zn/kg and 0.17 mg B/kg. The seeds of the *Physalis* species used were taken from local breeders. Compound fertiliser containing NPK (16:16:16) as much as 3 g/plant was applied at transplanting time and 14 days later to provide basic nutrition.

Experimental treatment. A factorial randomised block design with four replicates was used in this study. Each replication consisted of four plants. The *Physalis* sp. species, namely *P. peruviana* L., *P. alkekengi* L. and the purple genotype of *P. ixocarpa* Brot., was the first factor. The type of foliar nutrients was the second factor; it consisted of spraying water only as a control, macronutrients at a dose of 2 g/L, micronutrients at a dose of 0.125 g/L and a combination of macronutrients and micronutrients at a dose of 1 g/L and 0.0625 g/L, respectively. Macronutrients contain 22.9% P and 28.2% K, while micronutrients contain 5% Zn, 2.5% Fe, 2% Cu, 2% B, 0.1% Mo and 7% Mn. The treatment was started 10 days after transplantation and repeated every 14 days for a cultivation period of 90 days.

Experimental methods. Ripe fruit based on the criteria of Souza et al. (2017) was harvested for measurement of physical properties (fruit size, firmness and colour) and chemical properties (flavonoids, vitamin C, antioxidant activity, total titrated acid (TTA) and total soluble solids (TSS)). Five fruits were taken from each plant for analysis.

A digital calliper was used to measure the longitudinal and transverse diameter of the fruit. The colour of the *Physalis* fruits was measured using a colourimeter (Konica Minolta, Chroma Meter-CR-10, Tokyo, Japan) by evaluating the lightness (L*), redness (a*) and yellowness (b*) cartesian coordinates. The L* axis ranges from no lightness (0) to the highest lightness (100). The a* axis ranges from green (–a) to red (+a). The b* axis ranges from blue (–b) to yellow (+b). The texture analyses were carried out using a Stable Micro Systems TA.XT texture analyser tool (Surrey, UK). The test conditions consist of a 2 mm probe (P/2), a test speed of 1.00 mm/s and a distance of 6 mm. The findings were processed using Exponent software TEE (Stable Micro Systems, Surrey, UK), and a texture profile was generated to determine fruit stiffness (strength on the highest peak).

Vitamin C analysis was conducted by dissolving 0.5 mL of the filtered fruit juice with aquadest up to 100 mL. Its absorbance was determined at 265 nm (Arayne et al. 2009). The flavonoid was determined by mixing 1 mL extract with 3 mL of methanol, 0.2 mL of 10% $AlCl_3$, 0.2 mL of CH_3COOK and 5.6 mL of aquabidest. The absorbance of the supernatant was measured at 495 nm (Chang et al. 2002). Antioxidant activity was expressed using a DPPH (2,2-diphenyl-1-picrylhydrazyl) assay. The extract (1.0 mg/mL) was diluted in a 5 series solution concentration. A 2.4 mL solution was added to 0.6 mL of 50 mmol DPPH solution. After 30 min of incubation in a dark place, the absorbance was measured at 517 nm (A_{517}). The DPPH scavenging activity percentage (%) was calculated using the formula = [(A_{517} of control – A_{517} of the sample)/A_{517} of control] × 100. The result was then converted to IC_{50} (half maximal inhibitory concentration) (mg/mL). The lower its value, the higher its antioxidant

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Figure 1. Fruit of *Physalis* sp. is affected by foliar nutrition. (A) *Physalis peruviana*; (B) *P. alkekengi*, and (C) *P. ixocarpa*. Each image from left to right shows the control treatment, macronutrients, micronutrients, and nutrient combinations. Bar = 1 cm

activity (Gupta et al. 2014). TSS was assessed using a pocket digital refractometer (HT113ATC, Shandong, China) by placing a drop of fruit juice on the prism. TTA was evaluated by titrated filtrated fruit juice with 0.01 mol/L NaOH and phenolphthalein as indicators (Horwitz and Latimer 2005).

Experimental design and statistical analysis. The data obtained were analysed with an analysis of variance (ANOVA) followed by the least significant difference (*LSD*) at $P < 0.05$. Statistical analyses were generated using the Statistical Tools for Agricultural Research (STAR) 2.0.2 application (Laguna, Philippines).

RESULTS AND DISCUSSION

The planting media used had moderate organic carbon, organic matter, N and K, low P levels and a deficit of micronutrients Zn, B and Cu based on the critical limit of soil nutrient content of Patil et al. (2016). Fertilisation is regarded as one of the most effective techniques for enhancing earnings from fruit tree cultivation (Brunetto et al. 2015). Genetics, cultivation management and the environment affect fruit quality (Jamaly et al. 2021). This study showed significant interactions between the *Physalis* species and foliar nutrition in the physicochemical character of *Physalis* fruit (Figure 1).

Each species responded differently to the longitudinal and transverse diameters in foliar nutrition applications. This may be based on the availability of the most limiting nutrient for plant development and its efficiency in nutrient utilisation (Buss et al. 2018) (Figure 2). The largest *P. peruviana* fruit achieved using combined nutrients was 16.89 × 16.32 mm. This diameter was close to a previous study by Oliveira et al. (2016) of 16.90 mm. The diameter of *P. alkekengi* was not significantly different between the treatments. The largest average diameter was 12.10 × 12.72 mm. The largest diameter of the *P. ixocarpa* fruit was 35.63 × 40.94 mm. This result was achieved using macronutrients that were not significantly different from the combined nutrients. This was 27% larger than the wild purple genotype of *P. ixocarpa* in the study of Pérez-Herrera et al. (2021).

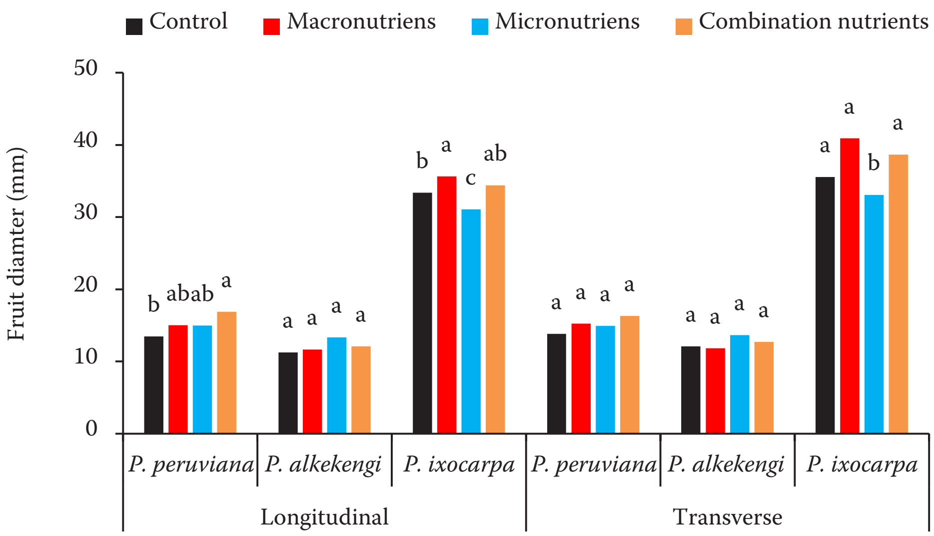

Figure 2. Effect of foliar nutrient on the diameter of *Physalis* fruit. Different letters indicate significant differences at $P < 0.05$

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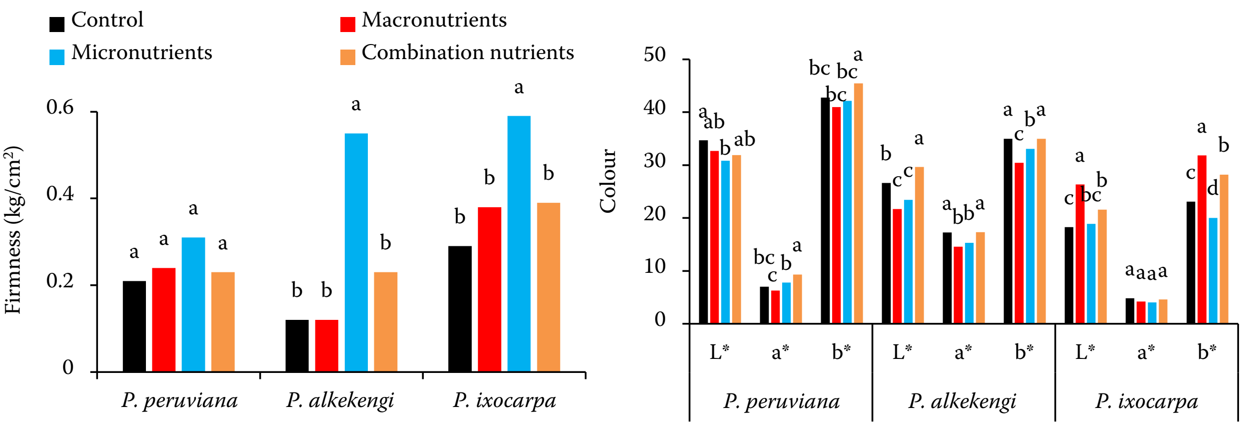

Figure 3. Effect of foliar nutrient on firmness and colour (lightness (L*), higher redness (a*) and yellowness (b*)) of *Physalis* fruit. Different letters indicate significant differences at $P < 0.05$

Figure 3 shows that the micronutrients produced the highest firmness with 0.31 kg/cm^2, 0.55 kg/cm^2 and 0.59 kg/cm^2, respectively, for *P. peruviana*, *P. alkekengi* and *P. ixocarpa*. Boron on micronutrient application is involved in cell wall biosynthesis and membrane integrity (Al-Hajjaj and Ayad 2018). At certain concentrations, it also stimulates calcium transfer into fruit cell walls, enhancing fruit firmness and storage life (Brunetto et al. 2015, Olmedo et al. 2021).

The results of the colour measurements showed that the highest L* of *P. peruviana* was obtained from the control with 34.67, the a* was not significantly different between all treatments and the highest b* was obtained from the combined nutrients with 45.43. The lightness and yellowness were below those of previous studies due to different environments, cultivars and cultivation practices (Oliveira et al. 2016). The highest L*, a* and b* of *P. alkekengi* were obtained from the combination-nutrient treatment with 29.63, 17.33 and 34.97, respectively. The highest L* and b* of *P. ixocarpa* were obtained from the macronutrient treatment at 26.33 and 31.80, respectively, while the highest a* was obtained from the combined-nutrient treatment at 9.33. These results recorded lower lightness and higher redness than in a previous study. A deeper purple intensity was observed, which is related to a higher anthocyanin content (Pérez-Herrera et al. 2021).

TSS and TTA are fruit quality parameters that directly impact fruit taste. TTA is associated with fruit acidity, whereas TSS is proportional to the amount of sugar (Oliveira et al. 2019). In addition to antioxidant content and activity, combined nutrition gave the highest TSS and lowest TTA (Figure 4). The lowest TTA of *P. alkekengi* and *P. ixocarpa* were 0.11% and 0.10%, respectively, which led to low fruit

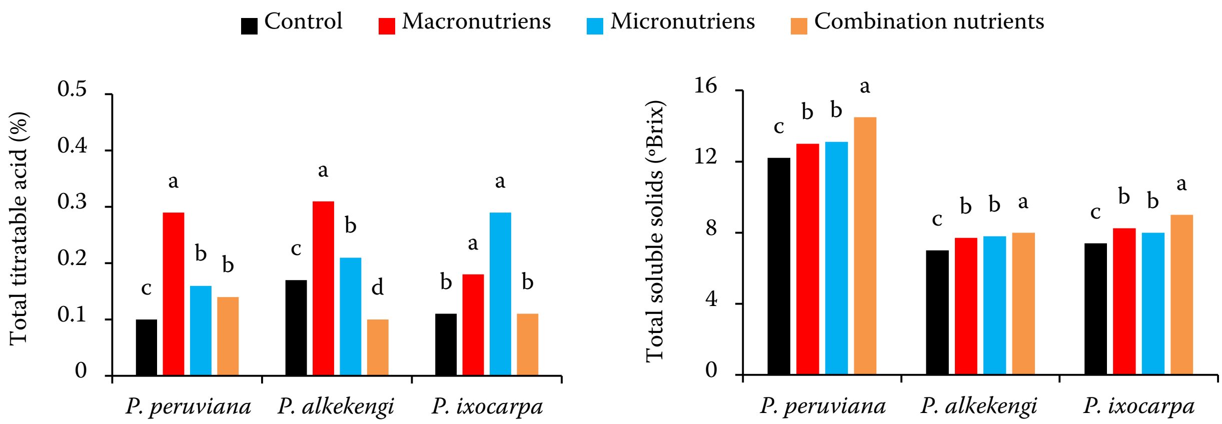

Figure 4. Effect of foliar nutrient on total titratable acid and total soluble solids of *Physalis* fruit. Different letters indicate significant differences at $P < 0.05$

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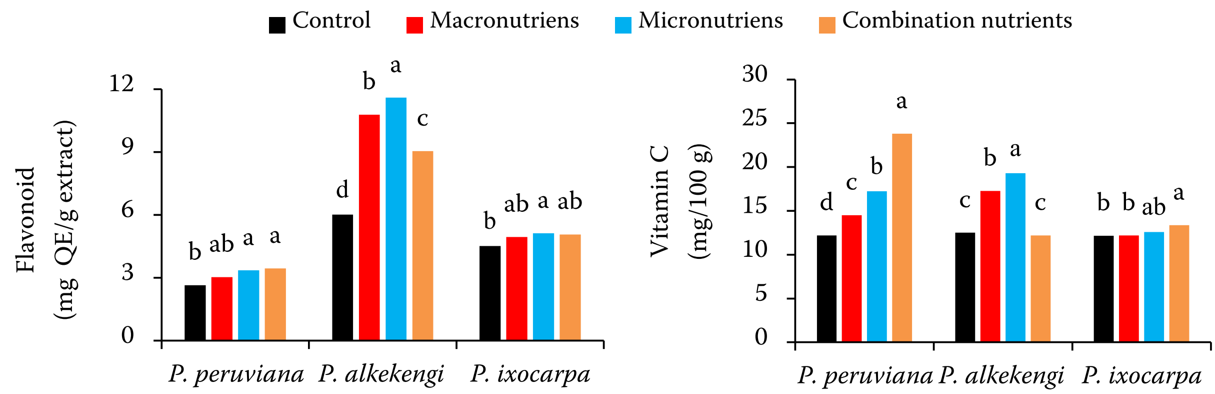
acidity, except for *P. peruviana*. The lowest value was observed in the control, with a TTA of 0.10%. The highest TSS of *P. peruviana*, *P. alkekengi* and *P. ixocarpa* were 14.5, 8.0 and 9.0 °Brix, respectively. The study recorded a lower TTA and a lower TSS of *P. peruviana* and a higher TSS of *P. ixocarpa* than a previous study by Shenstone et al. (2020). Combining both nutrients plays an essential role in increasing sugar translocation and converting organic acids into sugars (Soliman et al. 2016, Al-Hajjaj and Ayad 2018).

Researchers are interested in increasing the concentration of natural plant antioxidants to improve fruit quality and produce plants with high-stress tolerance. Flavonoids and vitamin C are prominent plant antioxidants that play an essential role in reducing excessive ROS (reactive oxygen species) production (Venkatesh and Park 2014, Panhwar et al. 2015). *P. peruviana* has the highest antioxidant activity, flavonoid and vitamin C of 0.091 mg/mL, 4.45 mg quercetin equivalent (QE)/g extract and 19.29 mg/100 g, respectively, obtained from combination nutrients (Figure 5). *P. alkekengi* has the highest antioxidant activity, flavonoid and vitamin C of 0.087 mg/mL, 11.59 mg QE/g extract and 19.29 mg/100 g, respectively, obtained from micronutrients. *P. ixocarpa* has the highest antioxidant activity and vitamin C of 0.104 mg/mL and 13.38 mg/100 g, respectively, obtained from combination nutrients and flavonoid of 5.12 mg QE/g extract obtained from micronutrients. Micronutrients act as cofactors for enzymes that regulate the activity and synthesis of antioxidant precursor amino acids. The use of micronutrients increases the absorption of macronutrients in rice (Panhwar et al. 2015). P and K are involved in three major metabolic pathways and plant regulatory factors (Soliman et al. 2016, Wei et al. 2021). Thus, P, K and micronutrients are essential combination nutrients to increase antioxidant content and activity. The results of this study have a higher vitamin C content and antioxidant activity than previous studies (Laczkó-Zöld et al. 2009, Iwansyah et al. 2020, Pérez-Herrera et al. 2021).

Exogenous plant nutrients are used to maintain plant production. A consistent supply of nutrients at optimal levels strengthens soils and plants' nutrient status and health (Bana et al. 2022). Our findings indicate that there is an interaction between species treatment and foliar nutrition. The foliar application of macro and micronutrients in combined form and a proper dose improves the physicochemical quality of *Physalis* fruit.



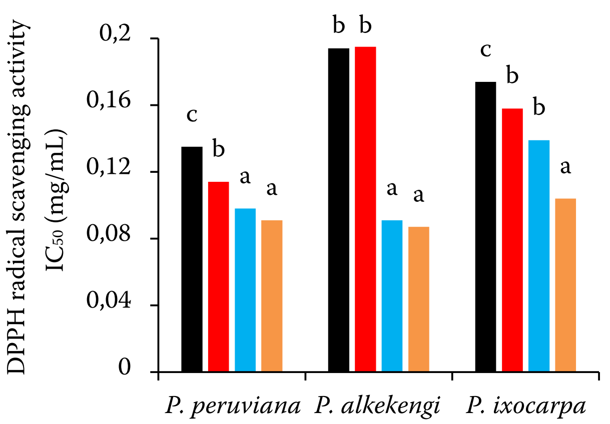


Figure 5. Effect of foliar nutrient on the antioxidant compound and activity of *Physalis* fruit. Different letters indicate significant differences at $P < 0.05$. QE – quercetin equivalent; DPPH – 2,2-diphenyl-1-picrylhydrazyl; IC_{50} – half maximal inhibitory concentration

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REFERENCES

Al-Hajjaj H.S., Ayad J.Y. (2018): Effect of foliar boron applications on yield and quality of Medjool date palm. Journal of Applied Horticulture, 20: 182–189.

Arayne M.S., Sultana N., Bibi Z. (2009): Rapid and specific spectrophotometric and RP-HPLC methods for the determination of ascorbic acid in fruits juices and in human plasma. Journal of the Chemical Society of Pakistan, 31: 402–407.

Bana R.S., Jat G.S., Grover M., Bamboriya S.D., Singh D., Bansal R., Choudhary A.K., Kumar, Laing A.M., Godara S., Bana R.C., Kumar H., Kuri B.R., Yadav A., Singh T. (2022): Foliar nutrient supplementation with micronutrient-embedded fertilizer increases biofortification, soil biological activity and productivity of eggplant. Scientific Reports, 12: 5146.

Brunetto G., De Melo G.W.B., Toselli M., Quartieri M., Tagliavini M. (2015): The role of mineral nutrition on yields and fruit quality in grapevine, pear and apple. Revista Brasileira de Fruticultura, 37: 1089–1104.

Buss J., Stratechuk K., Pinno B.D. (2018): Growth and competition among understory plants varies with reclamation soil and fertilization. Ecological Processes, 7: 12.

Chang C.C., Yang M.H., Wen H.M., Chern J.C. (2002): Estimation of total flavonoid content in propolis by two complementary colorimetric methods. Journal of Food and Drug Analysis, 10: 178–182.

Fallahi E., Eichert T. (2013): Principles and practices of foliar nutrients with an emphasis on nitrogen and calcium sprays in apple. HortTechnology, 23: 542–547.

Fiaz M., Wang C., Haq M.Z.U., Haider M.S., Zheng T., Ge M.Q., Jia H.F., Jiu S.T., Fang J.G. (2021): Molecular evaluation of kyoho grape leaf and berry characteristics influenced by different NPK fertilizers. Plants (Basel), 10: 1578.

Gupta V.K., Simlai A., Tiwari M., Bhattacharya K., Roy A. (2014): Phytochemical contents, antimicrobial and antioxidative activities of *Solanum sisymbriifolium*. Journal of Applied Pharmaceutical Science, 4: 75–80.

Horwitz W., Latimer G.W. (2005): Official Methods of Analysis of AOAC International. 18^{th} Edition. Maryland, Association of Official Analytical Chemistry International.

Iwansyah A.C., Surahman D.N., Hidayat D.D., Luthfiyanti R., Indriati A., Ardiansyah C.E. (2020): Comparative evaluation of proximate composition and vitamin C of *Physalis angulata* Linn and *Physalis peruviana* Linn in West Java, Indonesia. IOP Conference Series: Earth Environmental Science, 462: 012012.

Jamaly R., Parent S.-É., Parent L.E. (2021): Fertilization and soil nutrients impact differentially cranberry yield and quality in Eastern Canada. Horticulturae, 7: 1–18.

Laczkó-Zöld E., Zupkó I., Réthy B., Csedo K., Hohmann J. (2009): Antioxidant activity of the fruits and hydrophilic compounds of *Physalis alkekengi*. Acta Pharmaceutica Hungaria, 79: 169–173.

Muniz J., Kretzschmar A.A., Rufato L., Pelizza T.R., Rufato A.D.R., de Macedo T.A. (2014): General aspects of *Physalis* cultivation. Ciência Rural, 44: 964–970.

Oliveira L.A., da Silva E.C., de Carlos L.A., Maciel G.M. (2019): Phosphate and potassium fertilization on agronomic and physico-chemical characteristics and bioactive compounds of eggplant. Revista Brasileira de Engenharia Agrícola e Ambiental, 23: 291–296.

Oliveira S.F., Gonçalves F.J.A., Correia P.M.R., Guiné R.P.F. (2016): Physical properties of *Physalis peruviana* L. Open Agriculture, 1: 55–59.

Olmedo P., Zepeda B., Rojas B., Silva-Sanzana C., Delgado-Rioseco J., Fernández K., Balic I., Arriagada C., Moreno A.A., Defilippi B.G., Campos-Vargas R. (2021): Cell wall calcium and hemicellulose have a role in the fruit firmness during storage of blueberry (*Vaccinium* spp.). Plants (Basel), 10: 553.

Panhwar Q.A., Naher U.A., Radziah O., Shamshuddin J., Razi I.M., Dipti S.S., Aghamolki M.T.K. (2015): Quality and antioxidant activity of rice grown on alluvial soil amended with Zn, Cu and Mo. South African Journal of Botany, 98: 77–83.

Patil P.L., Kuligod V.B., Gundlur S.S., Katti J., Nagaral I.N., Shikrashetti P., Geetanjali H.M., Dasog G.S. (2016): Soil fertility mapping in Dindur sub-watershed of Karnataka for site specific recommendations. Journal of the Indian Society of Soil Science, 64: 381–390.

Pérez-Herrera A., Martínez-Gutiérrez G.A., Morales I., Sánchez-Medina M.A., Escamirosa-Tinoco C. (2021): Physicochemical characterization and antioxidant activity of wild *Physalis* spp. genotypes. Emirates Journal of Food and Agriculture, 33: 458–464.

Shenstone E., Lippman Z., van Eck J. (2020): A review of nutritional properties and health benefits of *Physalis* species. Plant Foods for Human Nutrition, 75: 316–325.

Soliman A.Sh., Hassan M., Abou-Elella F., Ahmed A.H.H., El-Feky S.A. (2016): Effect of nano and molecular phosphorus fertilizers on growth and chemical composition of baobab (*Adansonia digitata* L.). Journal of Plant Sciences, 11: 52–60.

Souza C.L.M., de Souza M.O., de Oliveira R.S., do Nascimento M.N., Pelacani C.R. (2017): Biometric characteristics of fruits and physiological characterization of seeds of *Physalis* species (*Solanaceae*). Agrária – Revista Brasileira de Ciências Agrárias, 12: 277–282.

Venkatesh J., Park S.W. (2014): Role of L-ascorbate in alleviating abiotic stresses in crop plants. Botanical Studies, 55: 38.

Wei F., Shi Z.G., Wan R., Li Y.X., Wang Y.J., An W., Qin K., Cao Y.L., Chen X.Y., Wang X.Y., Yang L.B., Dai G.L., Feng J.Y. (2020): Impact of phosphorus fertilizer level on the yield and metabolome of goji fruit. Scientific Reports, 10: 1–11.

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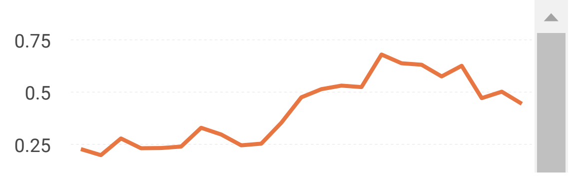

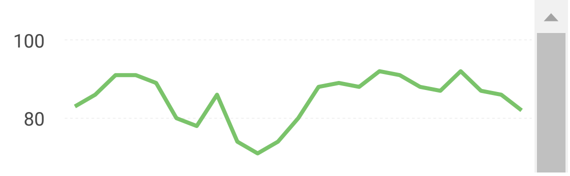

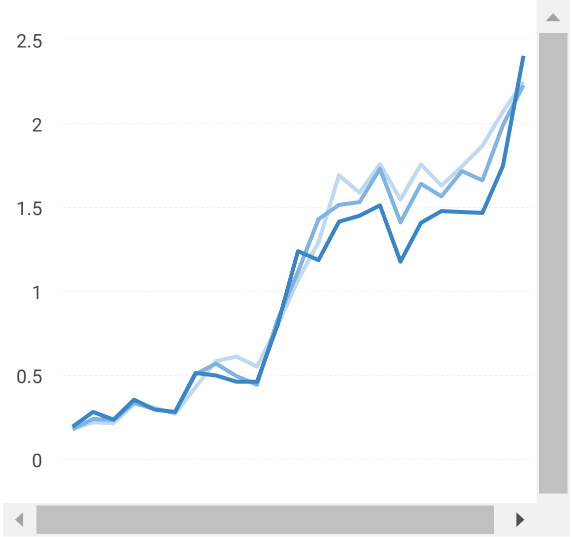

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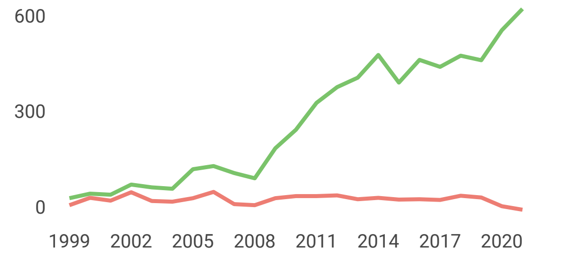

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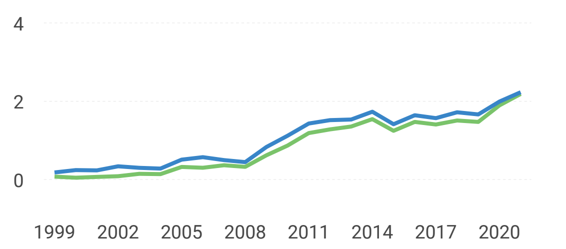

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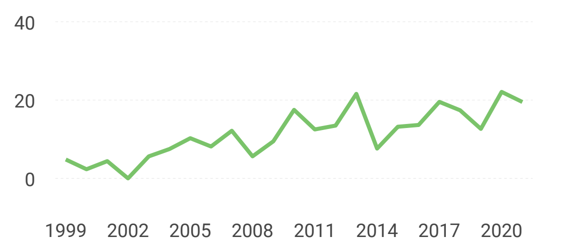

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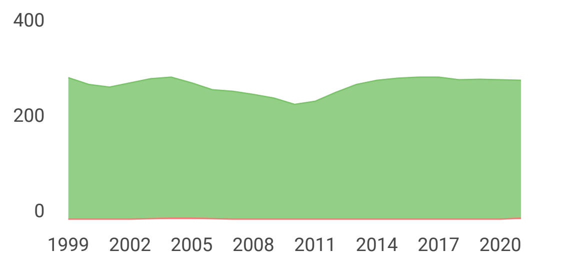

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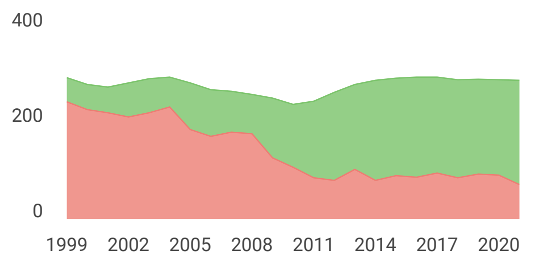

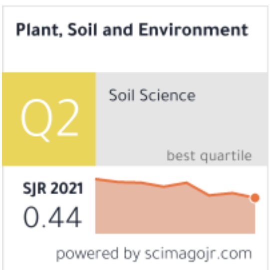

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