JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL. 7 NO. 1 January 2025

DOI :https://doi.org/10.36378/juatika.v7i1.3983
eissn 2656-1727
pissn 2684-785X
pages : 124 – 128

RESEARCH ARTICLE Open Access

# The Effectiveness of Planting based on The Number of Seeds in Increasing The Adaptability and Productivity of Sweet Corn

Suryanto[1], Sukriming Sapareng[1,*], Annas Boceng[2], Taruna Shafa Arzam AR[1], Akmal[1], Rosnina[1]

**Abstract**

This study aimed to evaluate the influence of the number of seeds per planting hole on the productivity and adaptability of sweet corn varieties. Using a nested research design, eight Indonesian commercial sweetcorn varieties were tested with variations in the number of seeds per planting hole. Results showed that plant height ranged from 144.86 cm to 191.66 cm, with the BN 44 variety having the highest height. However, seed number treatment did not significantly affect plant height, stem diameter, or leaf count. Meanwhile, the highest productivity is achieved by the Talenta and Bonanza 9 F1 varieties at the treatment of one seed per hole, as well as the Prima variety at the treatment of two seeds. These findings emphasize the importance of variety selection in the management of sweet corn cultivation and show that although seed numbers are insignificant, the right variety can improve crop yields. The implications of this research are important for the development of sustainable and efficient agricultural strategies and can contribute to food security through increased sweet corn productivity.

**Keywords:** Adaptation, Effectiveness, Number of Seeds, Sweet Corn

## 1. Introduction

Sweet corn (*Zea mays* saccharata Sturt) is a crucial food commodity that plays a significant role in meeting global nutritional needs, particularly in Indonesia, where corn serves as a staple food and a source of income for many farmers. Despite its importance, sweet corn production in Indonesia faces challenges due to climate change, resulting in low yields averaging below 10 tons per hectare, which is only a third of its potential. This situation has led to increased imports, rising from 1,010,178 tons in 2018 to 1,125,463 tons in 2022. The low productivity is attributed to cultivation primarily on marginal drylands, which encounter issues such as limited water availability and poor soil fertility (Sapareng et al., 2017) (Alotaibi, 2023).

One of the main strategies that has been extensively researched is the development of drought-resistant corn varieties capable of maintaining productivity even under water scarcity conditions (S. Chen et al., 2023). In addition to the importance of superior varieties, optimal cultivation practices, such as regulating the seed density per unit area and hormone application, also play a crucial role in enhancing production efficiency (Da Costa et al., 2019) (Asrijal et al., 2023) (Wira Hadianto et al., 2024).

Various efforts have been made to enhance sweet corn's resistance to drought stress, but specific issues remain unresolved, particularly in managing agricultural inputs like seed quantity (Rasheed et al., 2023). The number of seeds per unit land area significantly impacts plant competition, resource allocation, and overall yield (Lázaro & Larrinaga, 2018). However, there is a lack of in-depth research on how seed quantity variations influence sweet corn's productivity and adaptability. Previous studies have mainly focused on developing drought-resistant varieties or irrigation management, with limited exploration of the relationship between seed quantity variations and plant adaptability across different varieties (D. Chen et al., 2016; Wang et al., 2020).

Therefore, there is a need for comprehensive research to investigate the role of seed quantity in maximizing sweet corn production potential across various varieties, providing practical guidance for farmers and decision-makers. This study aims to determine the impact of plant density and different varieties on the growth and yield of sweet corn. Previous studies on plant density have often been conducted under ideal conditions without considering

*Correspondence: miming.mlgke@gmail.com
1) Universitas Andi Djemma - Jl. Sultan Hasanuddin No.13, Palopo City, Sulawesi Selatan 91913, Indonesia
2) Universitas Muslim Indonesia - Jl. Urip Sumoharjo, KM. 5 Makassar, Sulawesi Selatan 90231, Indonesia

genetic and environmental factors such as variety (Stein et al., 2016). This research gap underscores the importance of studying seed quantity variations in conjunction with different varieties to understand how plant density affects the adaptability and productivity of sweet corn.

The novelty of this study lies in its holistic approach, examining not only sweet corn productivity but also how seed quantity variations can optimize the adaptability of different sweet corn plants.

## 2. Material and Methods

This research was conducted in Pattimang Village, Malangke District, North Luwu Regency, South Sulawesi with an altitude of 5 m above sea level at coordinates 2o47'40 "S, 120o23'44" E. The study used a nested experimental design to handle situations with confounding factors or inhomogeneity of experimental materials (Pártay et al., 2014). A nested design was used because the two independent variables or factors in this study were in a nested classification, where one factor was in another factor. The first factor (A) was the number of seeds per planting hole, which consisted of several levels, while the second factor (B) was a commercial sweet corn variety consisting of 8 levels. Golden Boy, Prima, Talenta, BN 44, Manise, Bimmo, Bonanza 9 F1, and Maestro are these varieties. In this design, the levels of factor B are nested within the levels of factor A, meaning that the level of B at A1 is different from that of B at A2, and so on.

Factor A has several levels indicating variation in the number of seeds per planting hole, while factor B consists of eight different sweet corn varieties nested within each seed level. For example, varieties tested at a certain seed level are not the same as varieties tested at other seed levels, reflecting the nested structure of this experiment. This study was conducted with 3 replications nested within the variety factor, resulting in 48 experimental units (8 varieties x 3 replications x number of seed levels). The design aimed to observe the interaction between seed level and sweet corn varieties and the main effects of each factor on plant productivity and adaptability under drought conditions. Observations were made in the quadrants of the plot without involving edge plants. Data were collected through direct observation when the plants had reached 50% flowering. The data were analyzed using Microsoft Excel Software and SPSS Statistics software version 26.0. An F test was conducted with a significance level of 5%. If the results of the F test were significantly different, further testing was carried out using the BNJ test at a significance level of 5%.

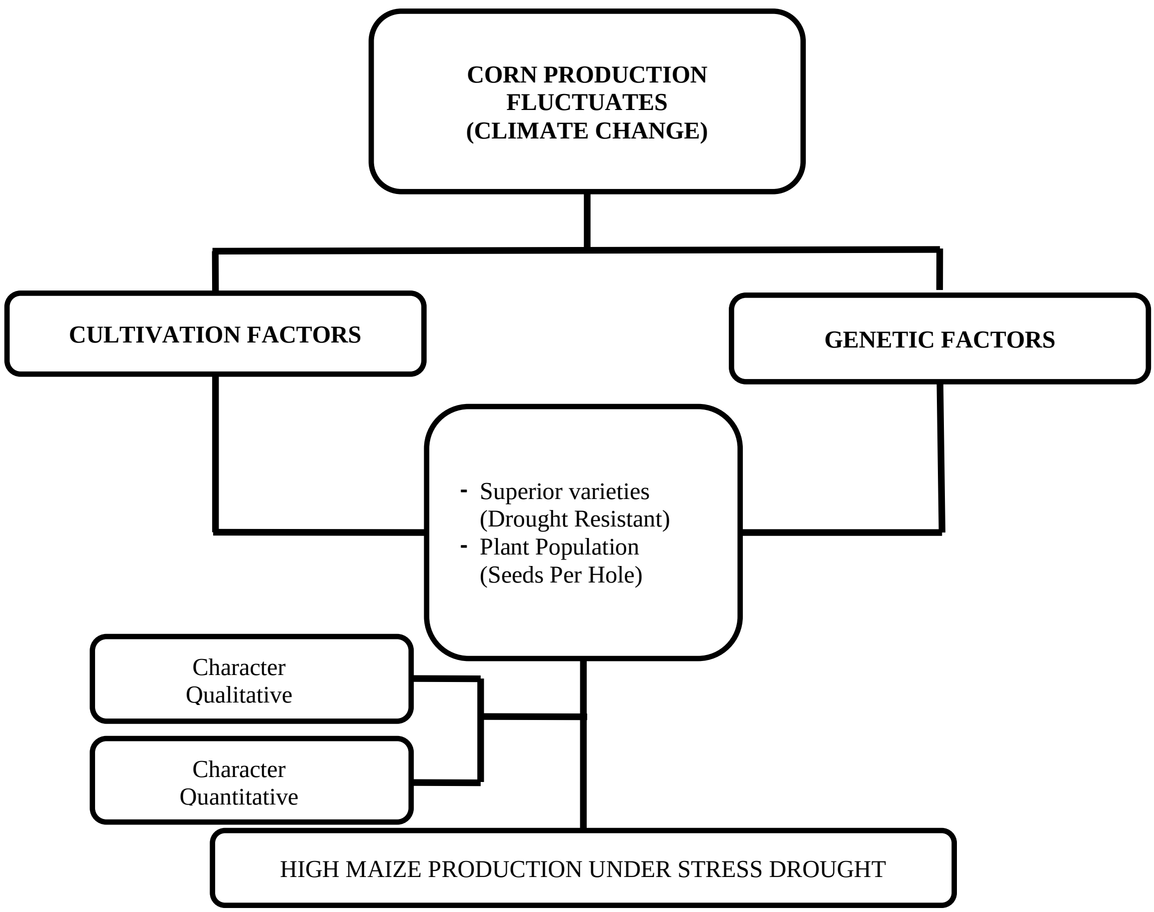


**Figure 1.** Research flow diagram

## 3. Results and Discussion

The results revealed that the sweet corn plant heights varied among the tested varieties, ranging from 144.86 cm to 191.66 cm. The BN 44 variety exhibited the tallest plants with an average height of 191.66 cm, while the Manise variety had the shortest plants with an average height of 144.86 cm, as shown in the table. The analysis indicated that the number of seeds per planting hole treatment did not significantly impact plant height for each variety. Similarly, the number of seeds per hole treatment did not significantly affect the stem diameter of the corn plants. The stem diameter ranged from 1.49 cm to 2.01 cm across varieties, with the Prima variety having the largest stem diameter (2.01 cm) and the Bonanza 9 F1 variety having the smallest diameter (1.49 cm).

**Table 1.** Recapitulation of the average values of plant height, stem diameter and number of leaves of 8 varieties of sweet corn (add standard error for each result/number)

| Varieties | Plant Height (cm) | Stem Diameter (cm) | Number of Leaves (strands) |
|---|---|---|---|
| Golden Boy | 164,07 ± 5,95$^{bcd}$ | 1,77 ± 0,13$^{abc}$ | 10,73 ± 0,25 |
| Prima | 167,77 ± 6,21$^{bcd}$ | 2,01 ± 0,15$^{a}$ | 11,07 ± 0,27 |
| Maestro | 171,25 ± 6,46$^{abc}$ | 1,51 ± 0,12$^{bc}$ | 11,03 ± 0,26 |
| Manise | 144,86 ± 4,88$^{d}$ | 1,59 ± 0,14$^{bc}$ | 10,31 ± 0,22 |
| Bimmo | 186,53 ± 7,53$^{a}$ | 1,69 ± 0,15$^{abc}$ | 11,60 ± 0,28 |
| Bonanza 9 F1 | 180,43 ± 7,20$^{ab}$ | 1,49 ± 0,12$^{c}$ | 11,43 ± 0,27 |
| BN 44 | 191,66 ± 7,65$^{a}$ | 1,87 ± 0,14$^{ab}$ | 11,30 ± 0,26 |
| Talenta | 150,90 ± 5,31$^{cd}$ | 1,85 ± 0,14$^{abc}$ | 11,57 ± 0,27 |
| HSD 5% | 20,62 | 0,38 | - |
| Mean 1 Seeds | 168,43 ± 6,07 | 1,66 ± 0,13 | 11,39 ± 0,27 |
| Mean 2 Seeds | 169,94 ± 6,13 | 1,78 ± 0,14 | 10,87 ± 0,26 |

Note: The figures presented represent the mean ± standard error. Similar letters adjacent to the mean value indicate differences that are not statistically significant based on the Honestly Significant Difference test at the 5% level.

The number of leaves per plant in all tested varieties was relatively uniform, ranging from 10 to 11 leaves, and there was no significant effect of the number of seeds per planting hole on the number of leaves produced. In the ear length parameter in Table 2, the results show that in treating one seed per hole, the BN 44 variety produced the longest ear with an average of 23.69 cm, while the Prima variety produced the shortest ear with an average of 17.73 cm. Conversely, in treating two seeds per planting hole, the Prima variety had the longest ear with an average of 19.53 cm, while the Talenta variety had the shortest ear with an average of 17.44 cm.

**Table 2.** Average value of cob length (cm) of 8 varieties of sweet corn (standard error added to each result/number)

| Varieties | Number of Seeds per Hole | | Average Variety |
|---|---|---|---|
| | One Seed | Two Seed | |
| Golden Boy | 20,23 ± 1,30$^{abc}$ | 18,39 ± 1,18$^{a}$ | 19,31 ± 0,98$^{ab}$ |
| Prima | 17,73 ± 1,14$^{c}$ | 19,53 ± 1,26$^{a}$ | 18,63 ± 0,93$^{b}$ |
| Maestro | 20,89 ± 1,34$^{abc}$ | 19,42 ± 1,24$^{a}$ | 20,16 ± 1,02$^{ab}$ |
| Manise | 19,22 ± 1,22$^{bc}$ | 19,51 ± 1,26$^{a}$ | 19,36 ± 1,00$^{ab}$ |
| Bimmo | 18,65 ± 1,18$^{bc}$ | 17,81 ± 1,14$^{a}$ | 18,23 ± 0,92$^{b}$ |
| Bonanza 9 F1 | 20,06 ± 1,29$^{abc}$ | 19,19 ± 1,22$^{a}$ | 19,62 ± 0,96$^{ab}$ |
| BN 44 | 23,69 ± 1,52$^{a}$ | 19,52 ± 1,26$^{a}$ | 21,61 ± 1,10$^{a}$ |
| Talenta | 22,28 ± 1,44$^{ab}$ | 17,44 ± 1,12$^{a}$ | 19,86 ± 1,06$^{ab}$ |
| HSD 5% | 3,91 | 3,91 | 2,76 |
| Average Number of Seeds | 20,34 ± 1,30$^{a}$ | 18,85 ± 1,21$^{b}$ | |

Note: The figures presented represent the mean ± standard error. Similar letters adjacent to the mean value indicate differences that are not statistically significant based on the Honestly Significant Difference test at the 5% level.

The weight per plot of plants also showed significant variation between varieties, as in Table 3. In the treatment of one seed per planting hole, the highest weight was produced by the Talenta variety with an average value of 5,949.67 g, while the lowest weight was produced by the Maestro variety with an average value of 2,387.33 g. In treating two seeds per planting hole, the Prima variety had the highest weight per plot (6,297.31 g), while the Manise variety had the lowest weight (1,719.72 g).

In terms of productivity, in the one seed per planting hole treatment, the Talenta variety recorded the highest productivity with an average of 29.7 tons $ha^{-1}$, followed by the Golden Boy variety (26.2 tons $ha^{-1}$). In contrast, the Maestro variety recorded the lowest productivity with an average of 12 tons $ha^{-1}$. In the two seed per planting hole treatment, the Bonanza 9 F1 variety showed the highest productivity with an average of 34.1 tons $ha^{-1}$, while the Manise variety showed the lowest productivity with an average of 8.6 tons $ha^{-1}$. These results indicate that sweet corn varieties adapt differently to seed number treatments, with some varieties showing better productivity increases when planted with two seeds per planting hole.

**Table 3.** Average Weight Value per plot (grams) of 8 Sweet Corn Varieties (add standard error to each result/number)

| Varieties | Number of Seeds per Hole | | Average Variety |
|---|---|---|---|
| | One Seed | Two Seed | One Seed |
| Golden Boy | 5.241,27 ± 765,64[ab] | 4.964,75 ± 725,14[abc] | 5.103,01 ± 509,63[ab] |
| Prima | 3.193,10 ± 652,83[bc] | 6.297,31 ± 860,71[ab] | 4.745,21 ± 603,45[abc] |
| Maestro | 2.387,33 ± 570,12c[c] | 3.560,60 ± 658,27[cd] | 2.973,97 ± 423,89[cd] |
| Manise | 2.816,33 ± 593,21[bc] | 1.719,72 ± 456,52[d] | 2.268,03 ± 367,54[d] |
| Bimmo | 3.243,67 ± 658,34[bc] | 4.250,73b ± 723,15[cd] | 3.747,20b ± 489,27[cd] |
| Bonanza 9 F1 | 4.845,00 ± 745,28[abc] | 6.822,40 ± 882,34[a] | 5.833,70 ± 589,76[a] |
| BN 44 | 2.820,33 ± 597,21[bc] | 3.737,07 ± 663,54[bcd] | 3.278,70 ± 430,76[cd] |
| Talenta | 5.949,67 ± 823,12[a] | 4.611,60 ± 712,28[abc] | 5.280,63 ± 535,45[ab] |
| HSD 5% | 2.652,18 | 2.652,18 | 1.811,73 |
| Average Number of Seeds | 3.812,09 ± 684,12 | 4.495,52 ± 741,19 | |

Note: The figures presented represent the mean ± standard error. Similar letters adjacent to the mean value indicate differences that are not statistically significant based on the Honestly Significant Difference test at the 5% level.

The study results show that the height of sweet corn plants varies among varieties, with the BN 44 variety being the tallest and the Manise variety being the shortest. This aligns with previous research indicating that genetic differences between varieties influence plant morphology, including height (Dang et al., 2023). However, the number of seeds per planting hole did not significantly impact plant height, suggesting that genetic factors play a more significant role in determining plant height than seed quantity. These findings underscore the importance of selecting suitable varieties for optimal growth, particularly in water-limited environments (Dang et al., 2023). This study's superior adaptability of the BN 44 variety highlights the importance of variety selection. Furthermore, variations in stem diameter indicate that genetic diversity significantly influences plant structure, independent of seed quantity (Igea et al., 2017).

The study found that larger stem diameters, as seen in the Prima variety, can enhance plant stability and improve nutrient distribution, increasing plant productivity (De Swaef et al., 2015). These findings offer valuable insights for sweet corn cultivation, particularly in seed input management and variety selection (Septiani Sinaga et al., 2023). While the number of seeds per planting hole did not significantly impact plant height, stem diameter, or leaf count, there was notable productivity variation among varieties, especially in the one and two-seed per-planting hole treatments. This highlights the importance of considering the interplay between genetic factors and cultivation techniques to boost production yields (Pardo-Giménez et al., 2020).

The study supports the notion that genetic diversity is crucial to productivity under specific conditions (L. M. Khmelnychyi, 2022). It also suggests that the optimal combination of seed inputs and varieties can enhance efficiency, particularly in varieties like Bonanza 9 F1 and Prima, which positively responded to increased seed numbers (Dadlani & Yadava, 2023).

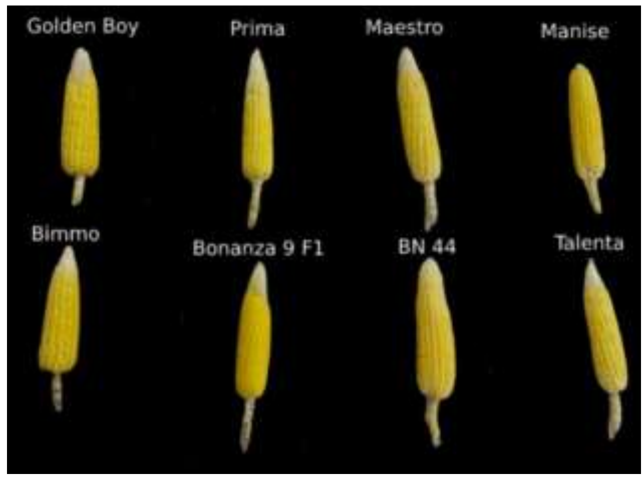


**Figure 2.** Appearance of cobs of various varieties of sweet corn

The practical implications of this research are particularly relevant for farmers seeking solutions to increase yields on limited land or in challenging environmental conditions. The significant increase in productivity for specific varieties, especially in the two-seed-per-hole treatment, suggests that with appropriate variety selection, this method can be applied to substantially increase yields without expanding the planting area (Kumar et al., 2022).

These results offer practical guidance for agricultural policymakers and farmers in selecting adaptive and productive sweet corn varieties based on existing land and environmental conditions. This study can also broaden the attention to new sweet corn varieties or hybrids more resilient to climate change, ultimately enhancing long-term food security (Huang et al., 2021). Therefore, sustainable agricultural research and practices should be the primary focus in implementing the findings of this study to support environmentally friendly and sustainable agriculture for the future.

## 4. Conclusion

This study revealed that the number of seeds per planting hole did not significantly impact plant height, stem diameter, or the number of leaves in sweet corn. However, the significant differences in productivity among varieties underscore the importance of selecting the right variety in sweet corn cultivation. The BN 44 variety exhibited the tallest plant height, while the Talenta and Bonanza 9 F1 varieties demonstrated the highest productivity in the one and two-seed per planting hole treatments. These results highlight the necessity of adopting a more holistic approach in variety selection and seed number management to enhance production efficiency.

**Acknowledgments**

The writers would like to thank the Directorate of Research, Technology and Community Service, Ministry of Education, Culture, Research and Technology, for the support and funding through the 2024 Beginner Lecturer Research Grant. This support is very valuable for the implementation and completion of this research. We hope that the results of this research can positively contribute to the development of science and practice in the field of agriculture and provide benefits to the general public.

**References**

Alotaibi, M. (2023). Climate change, its impact on crop production, challenges, and possible solutions. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 51*(1), 1–39. https://doi.org/10.15835/nbha51113020

Asrijal, A., Sapareng, S., Upe, A., Akmal, A., & Arzan AR, T. S. (2023). Testing of plant growth regulator and organic fertilizers on black rice plants. *Jurnal Teknik Pertanian Lampung (Journal of Agricultural Engineering, 12*(2), 484–494. https://doi.org/10.23960/jtep-l.v12i2.484-494

Chen, D., Wang, S., Cao, B., Cao, D., Leng, G., Li, H., Yin, L., Shan, L., & Deng, X. (2016). Genotypic variation in growth and physiological response to drought stress and re-watering reveals the critical role of recovery in drought adaptation in maize seedlings. *Frontiers in Plant Science, 6*(JAN2016), 1–15. https://doi.org/10.3389/fpls.2015.01241

Chen, S., Dang, D., Liu, Y., Ji, S., Zheng, H., Zhao, C., Dong, X., Li, C., Guan, Y., Zhang, A., & Ruan, Y. (2023). Genome-wide association study presents insights into the genetic architecture of drought tolerance in maize seedlings under field water-deficit conditions. *Frontiers in Plant Science, 14*(May), 1–18. https://doi.org/10.3389/fpls.2023.1165582

Da Costa, J. C., Almeida, A. R. de, Silva, M. R. B. da, Santos, J. C. S. dos, Leite, A. da S., & Junior, N. C. de L. (2019). Genetic parameters in the initial phase of collaborative plant breeding in lima beans (*Phaseolus lunatus*). *Journal of Experimental Agriculture International, 36*(6), 1–6. https://doi.org/10.9734/jeai/2019/v36i630250

Dadlani, M., & Yadava, D. K. (2023). *Seed science and technology: Biology, production, quality*. https://doi.org/10.1007/978-981-19-5888-5

Dang, D., Guan, Y., Zheng, H., Zhang, X., Zhang, A., Wang, H., Ruan, Y., & Qin, L. (2023). Genome-wide association study and genomic prediction on plant architecture traits in sweet corn and waxy corn. *Plants, 12*(2), 1–17. https://doi.org/10.3390/plants12020303

De Swaef, T., De Schepper, V., Vandegehuchte, M. W., & Steppe, K. (2015). Stem diameter variations as a versatile research tool in ecophysiology. *Tree Physiology, 35*(10), 1047–1061. https://doi.org/10.1093/treephys/tpv080

Huang, M., Wang, J., Wang, B., Liu, D. L., Feng, P., Yu, Q., Pan, X., & Waters, C. (2021). Assessing maize potential to mitigate the adverse effects of future rising temperature and heat stress in China. *Agricultural and Forest Meteorology, 311*(October), 108673. https://doi.org/10.1016/j.agrformet.2021.108673

Igea, J., Miller, E. F., Papadopulos, A. S. T., & Tanentzap, A. J. (2017). Seed size and its rate of evolution correlate with species diversification across angiosperms. *PLOS Biology, 15*(7), 1–16. https://doi.org/10.1371/journal.pbio.2002792

Kumar, S., Singh, R., & Singh, A. K. (2022). Impact of different spacing on production of pole type lima bean (*Phaseolus lunatus* L.) with intercropping of brinjal crop. *International Journal of Advanced Chemistry Research, 4*(2), 159–162. https://doi.org/10.33545/26646781.2022.v4.i2c.93

Khmelnychyi, L. M. (2022). Influence of genetic factors on indicators lifetime productivity of dairy cattle. *Тваринництво Степу України, 1*(2), 26–36.

Lázaro, A., & Larrinaga, A. R. (2018). A multi-level test of the seed number/size trade-off in two Scandinavian communities. *PLOS ONE, 13*(7), 1–20. https://doi.org/10.1371/journal.pone.0201175

Pardo-Giménez, A., Pardo, J. E., Dias, E. S., Rinker, D. L., Caitano, C. E. C., & Zied, D. C. (2020). Optimization of cultivation techniques improves the agronomic behavior of *Agaricus subrufescens*. *Scientific Reports, 10*(1), 1–9. https://doi.org/10.1038/s41598-020-65081-2

Pártay, L. B., Bartók, A. P., & Csányi, G. (2014). Nested sampling for materials: The case of hard spheres. *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics, 89*(2). https://doi.org/10.1103/PhysRevE.89.022302

Rasheed, A., Jie, H., Ali, B., He, P., Zhao, L., Ma, Y., Xing, H., Qari, S. H., Hassan, M. U., Hamid, M. R., & Jie, Y. (2023). Breeding drought-tolerant maize (*Zea mays*) using molecular breeding tools: Recent advancements and future prospective. *Agronomy, 13*(6), 1–21. https://doi.org/10.3390/agronomy13061459

Sapareng, S., Idris, M. Y., Akbar, T. W., Taruna, A. R., & Arzam, S. (2017). Pengaruh media tanah dan beberapa jenis pupuk organik terhadap pertumbuhan dan produksi tanaman jagung. *Jurnal Agrosains dan Teknologi, 2*(1), 43–50.

Septiani Sinaga, N., Andriani Luta, D., & Riah Ate Tarigan, R. (2023). Increasing the growth and production of sweet corn (*Zea mays saccharata*) by giving chicken manure and vegetable waste liquid organic fertilizer. *Jurnal Agronomi Tanaman Tropika (Juatika), 5*(2), 322–329. https://doi.org/10.36378/juatika.v5i2.3111

Stein, M., Miguez, F., & Edwards, J. (2016). Effects of plant density on plant growth before and after recurrent selection in maize. *Crop Science, 56*(6), 2882–2894. https://doi.org/10.2135/cropsci2015.09.0599

Wang, J., Hu, Z., Upadhyaya, H. D., & Morris, G. P. (2020). Genomic signatures of seed mass adaptation to global precipitation gradients in sorghum. *Heredity, 124*(1), 108–121. https://doi.org/10.1038/s41437-019-0249-4

Hadianto, W., et al. (2024). The effect of artificial crossing on the yield of several corn varieties (*Zea mays* L.). *Jurnal Agronomi Tanaman Tropika (JUATIKA), 6*(3), 923–930. https://doi.org/10.36378/juatika.v6i3.3812