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Effect of Combination of Reducing the Dose of NPK Fertilizer from the Recommended Dose and Providing Peptides and Seed Treatment with *Golden Grow* on Yield Growth and Yield Quality (*Zea mays* L.)

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Abstract

Corn plants are one of the food crops as a source of carbohydrates besides rice. The fertilization process is very important for plant growth and development. Fertilizers that are widely used by farmers include NPK fertilizers. This study aims to find the best seed soaking method that can increase the growth, yield and quality of corn yields, to determine the combination of a percentage reduction in the dose of NPK fertilizer from the recommended dose and the provision of peptides that do not reduce the growth, yield, and quality of corn yields, the interaction between seed soaking with a combination of reduced doses of NPK fertilizer and the provision of peptides that can increase growth, yield and quality of corn yields. The study used a *split plot* Randomized Group Design (RAK) with the main treatment, namely a reduction in the dose of NPK fertilizer consisting of 5 levels, namely Fertilization with NPK fertilizer according to the recommended dose without *Keratine Hydrolizate peptide* (KHP), The dose of NPK fertilizer is reduced by 10%, 20%, 30%, and 40% of the recommended dose.

+ KHP, The results of this study can show differences in seed soaking can increase growth yield, and quality of corn yield. Application of *Golden Grow* by soaking gave the highest growth of plant height, number of leaves, stem diameter, leaf chlorophyll content, relative water content, cob length, seed weight at 14% moisture content per plant, percentage of kernels, and weight per kernel. Percentage reduction of NPK fertilizer dose up to 20% accompanied by peptide application did not reduce yield as well. The combination of fertilization treatment according to the recommended dose with seed soaking using *Golden Grow* and the farmer's way gave the highest results on leaf color variables.

Keywords: Maize; Dosage; Golden Grow; Peptide

1. Introduction

Maize (*Zea mays* L.) is one of the main food commodities that plays a major role in supporting food security and the Indonesian economy. Based on data from the Central Bureau of Statistics (BPS., 2023), Indonesia's maize production reached 18.9 million tons in 2022. The high agronomic potential of maize and the flexibility of its utilization make this crop very feasible to be further developed with an efficient and environmentally friendly cultivation approach. Maize cultivation still faces a number of challenges that affect productivity. One of the main problems is poor seed quality and farmers' dependence on inorganic fertilizers, especially NPK fertilizers. The use of growth regulators such as *Golden Grow* containing IBA (*Indole Butyric Acid*) has been shown to increase vegetative plant growth, including roots and leaves, thus supporting maize productivity (Sharma *et al*., 2023). *Golden Grow* is a product based on the hormone IBA (Indole Butyric Acid) which belongs to the synthetic auxin group. IBA is known to stimulate root formation, accelerate cell division and enlargement, and increase seed germination. Peptides are active compounds composed of amino acid chains and function to strengthen plant physiological mechanisms. Peptides extracted from animal waste such as poultry feathers or fish scales are high in keratin and collagen, as well as sulfur amino acids such as methionine and

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cysteine, which are important in root growth, enzyme formation, and resistance to environmental stress (CH Biotech R&D Co., Ltd., 2023). The use of peptides has been shown to improve fertilizer use efficiency, stimulate plant growth, and increase crop yields, even when NPK fertilizer is reduced to 20% of the recommended dose (Zhou *et al.,* 2022).

2. Materials and methods

This research was conducted from June 2024 to October 2024. This research was conducted in two places, namely in Subak Kerdung, Jalan Pulau Moyo, Pedungan Village, South Denpasar and Agronomy and Horticulture Laboratory, Faculty of Agriculture, Udayana University. The study used a *split plot* design with 2 factors and 2 replications. The first factor as a subplot is the soaking of seeds before planting with *Golden Grow* (B) consisting of 3 levels, namely: Bp: Seeds soaked with water for 10 hours following the farmer's way without the application of *Golden Grow* /GG; Bs: Seeds were sprayed with 1 ml GG/200 ml. water/5 kg of seeds, then soaked for 4 hours accompanied by flipping the seeds so that they are evenly exposed to air; Bg: The seeds were soaked for 4 hours with GG solution (1 ml GG/1 liter of water/1 kg of seeds), then air dried. While the second factor as the main plot is a reduction in the dose of NPK fertilizer from the recommended dose accompanied by the provision of peptides (P) consisting of 5 levels, namely: P_0: Fertilization with NPK fertilizer according to the recommended dose (Phonska fertilizer 350 kg/ha and Urea 250 kg/ha) without KHP; $P_{1:}$NPK fertilizer dose reduced by 10% from the recommended dose (Phonska fertilizer 315 kg/ha and Urea 225 kg/ha) + KHP; $P_{(2:}$+) NPK fertilizer dose reduced by 20% of the recommended dose (Phonska 280 kg/ha and Urea 200 kg/ha) + KHP; $P_{3:}$NPK fertilizer dose reduced by 30% of the recommended dose (Phonska 245 kg/ha and Urea 175 kg/ha) + KHP; $P_{4:}$NPK fertilizer dose reduced by 30% of the recommended dose (Phonska 245 kg/ha and Urea 175 kg/ha) + KHP. The tools used in this study were buckets, scales, sieves, rulers, meters, tractors, rakes, hoes, counters, scissors, ajir, PPE, measuring cups, sprayers, LUX meters, chlorophyll meters, vectors, leaf color charts, relative water content (KAR) measuring instruments, corn grinding machines, and stationery. The materials used in this research were corn seeds of Bisi 18, *Golden Grow*, *Keratin Hydrolyzate Peptide* (KHP), Urea, Phonska Plus 15-15-15, and compost. The implementation of the research consisted of several stages, namely giving seed treatment by soaking and spraying *golden grow*, tillage and making plots, planting and applying fertilizer, giving *keratin hydrolyzate peptide*, plant maintenance and harvesting and post-harvest. Data were analyzed using *Analysis of Variance* (ANOVA) according to the design used. If the treatment given shows significantly or very significantly different, the BNT further test is carried out at the 5% level.

3. Results

3.1. Plant Height, Number of Leaves and Stem Diameter

Plant height variable in Table 1. shows that in the seed soaking treatment (B), treatment level Bg tends to show the highest results of 259.42 cm, not significantly different from treatment Bp (253.52 cm), but significantly different from treatment level Bs (250.75 cm). The result of the treatment factor of reduced fertilizer dosage (P) shows that the P0 treatment level tends to give the highest results of 265.42 cm, significantly different from the P1, P2 and P3 treatments and not significantly different from the P4 treatment level. The number of leaves in Table 1. shows that in the seed soaking treatment (B), the treatment level Bg tends to show the highest number of leaves which is 13.20 strands, not significantly different from the treatment Bp (13.13 strands), but significantly different from the treatment level Bs (12.72 strands). The results of the treatment factor of reduced fertilizer dose (P) showed that the treatment level P4 tended to give the highest number of leaves, namely 13.81 strands, significantly different from all other treatment levels. The stem diameter variable in Table 1. shows that in the seed soaking treatment (B), treatment level Bg tends to show the highest results of 2.28 cm, but not significantly different from treatment Bp (2.25 cm) and treatment level Bs (2.26 cm). The results of the fertilizer dose reduction factor (P) showed that the P2 treatment level tended to give the highest results, namely 2.37 cm, but not significantly different from the treatment level P1, P0 and P3 and significantly different from the treatment level P4.

Table 1 Effect of Various Seed Soaking Methods (B) and Reduction of Fertilizer Dosage (P) on Variables of Plant Height, Number of Leaves, Percentage of Seeds Grown and Stem Diameter

Treatment	Plant height	Number of Leaves	Stem Diameter
Seed Soaking (B)		**(strands)**	**(cm)**
Bg	259.42 a	13.20 a	2.28 a
Bp	253.52 ab	13.13 a	2.25 a
Bs	250.75 b	12.72 b	2.26 a
BNT 5%	6.74	0.41	0.10
Dosage of NPK fertilizer accompanied by peptide administration (P)			
P0	265.42 a	13.47 b	2.24 a
P1	255.31 b	13.25 b	2.25 a
P2	257.00 b	11.69 d	2.37 a
P3	237.03 c	12.86 c	2.27 a
P4	258.06 ab	13.81 a	2.20 b
BNT 5%	8.36	0.28	0.14

Notes: Numbers followed by the same letter in the same treatment and column indicate that they are not significantly different at the 5% level of the least significant difference (BNT) test.

3.2. Leaf Chlorophyll Content, Relative Water Content and Cob Length

Table 2 Effect of Various Seed Soaking Methods (B) and Reduction of Fertilizer Dosage (P) on Variables of Leaf Chlorophyll Content, Relative Water Content and Cobs Length

Treatment	Leaf chlorophyll content	SPAD) Leaf KAR (%)	(Cob length (cm)
Seed Soaking (B)			
Bg Bp Bs	43.27 a 43.01 a 43.06 a	88.39 a 87.38 a 86.14 a	19.16 a 18.78 a 19.13 a
BNT 5%	1.21	3.47	0.52
Dosage of NPK fertilizer accompanied by peptide administration (P)			
P0	44.53 a	88.72 a	18.74 c
P1	43.58 ab	88.02 a	19.57 b
P2	42.15 bc	89.44 a	20.06 a
P3	40.69 c	85.27 a	18.72 c
P4	44.58 a	85.08 a	18.03 d
BNT 5%	2.31	5.90	0.40

Description: N u m b e r s followed by the same letter in the same treatment and column indicate that they are not significantly different in the least significant difference test (BNT) at the 5% level.

The variable leaf chlorophyll content in Table 2 shows that in the seed soaking treatment (B), treatment level Bg tends to show the highest results of 43.27 SPAD, which is not significantly different from treatment level Bp (43.01 SPAD) and Bs (43.06 SPAD). The results of the treatment factor of reduced fertilizer dose (P) showed that the treatment level of P4 tended to give the highest results of 44.58 SPAD, significantly different from the treatments P2 and P3 and not significantly different from the treatment levels P0 and P1. The relative water content variable in Table 2. shows that in the seed soaking treatment (B), the treatment level Bg tends to show the highest results of 88.39%, which is not

significantly different from the treatments Bp (87.38%) and Bs (86.14%). The results of the treatment factor of reduced fertilizer dose (P) showed that the treatment level of P0 tended to give the highest results of 88.72%, not significantly different from all other treatment levels. The variable of cob length in Table 2 shows that in the seed soaking treatment (B), the treatment level of Bg tends to show the highest results of 19.16 cm, which is not significantly different from the treatments Bp (18.78 cm) and Bs (19.13 cm). Treatment level Bp tends to have the lowest value. The results of the treatment factor of reduced fertilizer dose (P) show that the treatment level P2 tends to give the highest result of 20.06 cm, significantly different from all other treatment levels.

Harvest dry seed weight, 14% moisture content seed weight per plant, 14% moisture content seed weight per plant and 14 tons moisture content seed yield per hectare.

The dry seed weight variable in Table 3 shows that in the seed soaking treatment (B), the treatment level Bg tends to show the highest results of 223.28 g, which is not significantly different from the treatments Bp (222.25 g) and Bs (223.13 g). The results of the fertilizer dose reduction treatment factor (P) showed that the P2 treatment level tended to give the highest yield of 237.53 g, but it was not significantly different from the P1 treatment level and significantly different from the P0, P3 and P4 treatment levels. Seed weight variable at 14% water content per plant in Table 3. shows that in the seed soaking treatment (B), the treatment level Bg tends to show the highest results of 183.77 g, which is not significantly different from the treatments Bp (179.92 g) and Bs (182.50 g). The results of the fertilizer dose reduction treatment factor (P) showed that the P2 treatment level tended to give the highest yield of 196.67 g, but it was not significantly different from the P1 treatment level and significantly different from the P0, P3 and P4 treatment levels. The seed weight variable of 14% water content in Table 3. shows that in the seed soaking treatment (B), the treatment level Bp tends to show the highest results of 8.50 kg, but not significantly different from the treatment level Bg (8.36 kg) and the treatment level Bs (8.49 kg). Treatment level Bg tends to have the lowest value. The results of the fertilizer dose reduction treatment factor (P) show that the P1 treatment level tends to give the highest yield of 96.80%, which is not significantly different from all levels. other treatments. The variable of seed weight a t 14% moisture content in Table 3 shows that in the seed soaking treatment (B), the treatment level Bp tends to show the highest results of 13.60 tons/ha, but not significantly different from the treatment level Bg (13.37 tons/ha) and the treatment level Bs (13.59 tons/ha). Treatment level Bg tends to have the lowest value. The results of the treatment factor of reduced fertilizer dose (P) show that the treatment level P1 tends to give the highest yield of 14.80 tons/ha, which is not significantly different from all other treatment levels.

Table 3 Effect of Various Seed Soaking Methods (B) and Reduction of Fertilizer Dosage (P) on Variables of Harvest Dry Seed Weight, 14% Moisture Content Seed Weight per Plant, 14% Moisture Content Seed Weight per Plant and 14 Ton Moisture Content Seed Yield Per Hectare.

Treatment	Seed soaking dry harvest(g)	Seed weight at 14% moisture content per plant (g)	Seed Weight at 14% moisture content per plant (kg/plant)	Seed Yield at 14% moisture content per hectare (ton/ha)
seed weight (B)				
Bg	223.28 a	183.77 a	8.36 a	13.37 a
Bp	222.25 a	179.92 a	8.50 a	13.60 a
Bs	223.13 a	182.50 a	8.49 a	13.59 a
BNT 5%	12.33	10.60	0.40	0.63
Dosage of NPK fertilizer accompanied by peptide administration (P)				
P0	217.33 b	175.06 b	8.17 c	13.07 c
P1	236.69 a	191.36 a	9.25 a	14.80 a
P2	237.53 a	196.67 a	8.59 b	13.76 b
P3	218.03 b	176.67 b	8.59 b	13.75 b
P4	204.86 b	170.56 b	7.64 d	12.23 d
BNT 5%	13.67	11.42	0.29	0.47

Description: Numbers followed by the same letter in the same treatment and column indicate that they are not significantly different in the least significant difference test (BNT) at the 5% level.

4. Discussion

The treatment of *Golden Grow* (GG) solution on the variable of harvest dry seed weight shows that the treatment of soaking seeds with *Golden Grow* (Bg) tends to give the best results of 223.28 g, but not significantly different from the treatment level of soaking seeds by farmers (Bp) which is 222.25 g and the treatment level of soaking seeds by spraying (Bs) which is 223.13g. The high harvest dry seed weight in the Bg treatment was also supported by growth, physiological and yield variables, such as plant height, number of leaves, stem diameter, leaf chlorophyll content, relative water content, cob length and seed weight at 14% water content per plant. Soaking seeds with *Golden Grow* can increase germination which is characterized by the growth of the seedlings.

Faster and uniform seeds because its auxiliary content helps accelerate the main physiological processes in germination. Application of IBA to seeds increases radicle and plumula elongation [9]. Seed soaking treatment also increases plant height and stem diameter, as a result of stimulation of cell elongation and division, as well as strengthening of vascular tissues by auxin [2]. Plant height shows the ability of plants to absorb light for the continuity of the photosynthesis process. Setiawan *et al*., [8] stated that corn plant height has a significant effect on the weight of dry kernels because of its correlation with leaf area and cob formation. Diamater describes the sturdiness of the plant. Widhyastuti *et al*. [10] showed that there is a positive correlation between stem diameter and dry kernel weight. The large number of leaves supports the production of photosynthetic products. In accordance with the research of Lestari *et al*., [6] that the increase in the number of leaves contributes to the weight of dry corn kernels. High relative water content causes the greater potential weight of dry shelled seeds produced because the process of photosynthesis and seed filling can take place optimally. According to Kandowangko's research[5] treatments that increase RWC (such as microbial inoculation) result in an increase in corn dry kernel weight. The single factor results of peptide spraying accompanied by a 10% reduction in NPK fertilizer dosage (P1), showed that the yield of 14% moisture content seeds per hectare w a s high at 14.80 tons/ha, significantly different from the control treatment (P0). The high yield of 14% moisture content seeds per hectare in the P1 treatment was supported by the variable weight of 14% moisture content seeds per planting (9.25 kg). Yield per hectare is closely related to yield per plant. The variable yield per seedling serves as a sample or small-scale representation used to describe the yield per hectare. This is in line with the research conducted by Purnaning & Pertiwi [7] which states that the yield per seedling can be utilized as a predictive tool to estimate yield on a per hectare scale. The use of peptides has the potential to increase the efficiency of fertilizer use, because peptides act as molecular signals that help optimize the absorption of nutrients by plants. The use of peptides has the aim of reducing the use of inorganic fertilizers and increasing crop production yields [3].

The results of the peptide spraying treatment accompanied by a 20% reduction in NPK fertilizer dosage (P2), showed a 14% moisture content seed yield per hectare of 13.76 tonnes/ha, not different from the treatment without peptide spraying+ without a reduction in NPK fertilizer dosage (P0) (13.07 tonnes/ha). The high seed yield of water content

The high seed yield of 14% moisture content per hectare in P2 treatment was supported by growth variables and yield components ranging from harvest dry seed weight (237.53 g), seed weight of 14% moisture content per plant (196.67 g), relative water content (89.44%) and cob length (20.06 cm) and stem diameter (2.37 cm). The treatment of peptide spraying accompanied by a reduction in the dose of NPK fertilizer was able to provide results that tended to be higher than P0. This is in line with the research of El-Sanatawy *et al*., [4] which showed that the application of peptides through spraying on wheat plants can increase the accumulation of nitrogen elements, seed yield, yield components and plant productivity compared to untreated (control). The length of the cob contributes to the increase in harvest dry seed weight, where the longer the cob the potential number of seeds per row the number increases so that the potential for the potential weight of small seeds increases. Abebe *et al*., [1] stated that cob length makes a considerable direct contribution to the weight of harvested dry beans.

5. Conclusion

Differences in seed soaking can increase yield growth, and quality of corn yield. The application of *Golden Grow* by soaking gave the highest growth of plant height, number of leaves, stem diameter, leaf chlorophyll content, relative water content, cob length, seed weight at 14% water content per plant, but was not significantly different from the treatment by spraying *Golden Grow* solution or by soaking as usually done by farmers. Percentage reduction of NPK fertilizer dose up to 20% accompanied by peptide application did not inhibit growth and reduce yield, while reduction of NPK fertilizer dose up to 10% accompanied by peptide application gave a high yield of 14% moisture content seeds, namely 14.80 tons/ha, higher than the control treatment.

Compliance with ethical standards

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References

[1] Abebe, B., Tulu, L., Tadesse, A., & Dargicho, D. 2020. Correlation and Path Coefficient Analysis of Grain Yield and Yield Related Traits in Quality Protein Maize (*Zea mays* L.) Hybrids. International Journal of Plant Breeding and Crop Science, 7(3), 019-028.

[2] Andianingsih, N., Rosmala, A., & Mubarok, S. (2021). Effect of Hormones Auxin and Gibberellin on the Growth of Tomato (Solanum lycopersicum L.) Var. Aichi First. Agroscript, 3(1), 48-56. https://e- journal.unper.ac.id

[3] CH Biotech Research & Develpoment Co., Ltd. 2023. CHB Solutian for the next Generation -Keratin *Hydrolysate Peptide* Technical Information. Taiwan.

[4] El-Sanatawy, A. M., Ash-Shormillesy, S. M. A. I., El-Yazied, A. A., Abd El-Gawad, H. G., Azab, E., Gobouri, A. A., Sitohy, M., and Osman, A. (2021). Enhancing grain yield and nitrogen accumulation in wheat plants grown under a Mediterranean arid environment by foliar spray with papain-released whey peptides. Agronomy, 11(10).

[5] Kandowangko, N. Y. 2018. Drought Solution for Maize Crops: Utilization of Azospirillum and Mikoriza Arbuscula Microbes. Gorontalo State University

[6] Lestari, D., Fatarib, I., & Fatmawati, A. 2023. Growth and Production of Maize Plants (Zea mays L.) in Legowo Row Planting System and Planting Direction. Agrotan Journal, 9(1), 7-11

[7] Purnaning, N. W. T. P., & Pertiwi, P. R. 2016. Increasing Rice Productivity through Field School of Ipdmip Program. 1-23.

[8] Setiawan, A. B., Endrawati, T., Puspitorini, P., & Kurniastuti, T. 2024. Growth and Yield Response of Maize (Zea mays L.) Variety Bisi 18 to Planting Distance and Bokashi Fertilizer. Grafting: Scientific Journal of Agricultural Sciences, 14(1), 36-46.

[9] Sharma, S., Meena, R. K., & Rathore, S. 2023. Effect of plant growth regulators on seed germination and early seedling growth. Journal of Plant Biology, 66(2), 110 -118.

[10] Widhyastuti, R. D., Mahendra, I. G. A., & Aryana, I. M. 2018. Growth and Yield of Maize in Combination of Variety and Planting System. Journal of Tropical Agroecotechnology, 7(3), 293 -302.