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Motivation of farmer group members in the application of balanced fertilization in maize (*Zea mays*) plant cultivation

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ABSTRACT

Balanced fertilizer application technology aims not only to increase crop production but also to improve fertilizer efficiency and protect the environment from agrochemical pollution. However, its application in the field still faces several barriers, both technical and non-technical. This study aims to determine the level of farmer motivation to apply balanced fertilization in maize production, identify the factors that influence the level of farmer motivation, and develop effective strategies. In addition, the study aims to compare maize plant growth between farmers' habits and the application of balanced fertilization. The methods used in this study were descriptive and multiple linear regression. The descriptive quantitative method was used while the data were collected through observation, questionnaires, interviews, and literature studies. The population consisted of 181 maize farmers who were members of farmer groups. The respondents were 65 individuals selected through purposive sampling from 181 individuals who were members of farmer groups and engaged in maize cultivation. In addition, field experiments were conducted with two treatments: farmers' custom or P0, consisting of urea 400 + NPK 15-15-15 100 kg/ha + fertilizer scattered on the soil surface, and balanced fertilization or P1, consisting of urea 300 + NPK 15-15-15 300 kg/ha + fertilizer buried in the soil. The results of the study showed that the farmers' motivation to apply balanced fertilization was in the medium category with 67.7%. The study also identified two significant factors that influenced the farmers' motivation, namely the function of farmer groups with $p = 0.004$ and government support with $p = 0.001$. To increase farmer motivation, socialization programs should focus on the lowest indicator value, which was the ability of farmers to apply balanced fertilization. The field experiments showed that the growth of maize plants in the balanced fertilizer treatment was significantly better than that in the farmer's habit treatment. This was indicated by plant height, number of leaves, dry kernel yield, and cob+husk yield.

1. Introduction

West Java is one of the main centers for maize production in Indonesia, with one of the highest average productivity rates (Agustiani et al., 2018). In Indonesia, the potential maize production can reach up to 14-18 tons/ha, and Majalengka Regency in West Java is well-suited for maize cultivation due to its altitude range of 19-857m above sea level and land slope of 0-40%.

Maja district is located in Majalengka Regency and has experienced farmer groups who cultivate maize. However, despite the regency's overall contribution, maize productivity in the Maja district remains relatively low at approximately 7.46 tons/ha, as reported by the Program Kecamatan Maja in 2020. While this is above the national average of approximately 5 tons/ha, it is still far below the potential productivity for the region.

One of the causes of low maize productivity is problems in technical cultivation, starting from land preparation, planting, maintenance, and harvesting. According to the 2020 Maja District Program report, the application of the Integrated Crop Management

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(ICM) technology package for maize by the main actors is still inconsistent. Based on this report, approximately 29% of farmers have not applied balanced fertilization technology.

Meanwhile, balanced fertilization refers to the application of fertilizer based on the needs of plants and soil conditions, creating a balance of nutrients that is favorable for plant growth (Husnain et al., 2016a). Maize, for instance, requires a significant amount of N fertilizer (urea), while soybeans only require a small amount. Fertile soil naturally provides nutrients in large quantities, and additional fertilizer is only needed in small amounts, and vice versa. Typically, plants require N, P, and K fertilizers to increase their production, as these three nutrients are needed in significant amounts, but their availability in the soil is limited (Oyetunji et al., 2022). Before balanced fertilization is applied, soil improvers or ameliorants are needed to ensure optimal results (Haryati et al., 2019).

Balanced fertilization technology serves to increase crop production, improve fertilizer efficiency, and reduce agrochemical pollution. Despite its many benefits, the technology faces several technical and non-technical obstacles in the field. To be effective, balanced fertilization must adhere to five rules: the right type, dose, time, form or formula, and method. However, in practice, most farmers have not fully followed all five rules, resulting in suboptimal crop production (SRI, 2023).

Unbalanced use of fertilizers will lead to lower productivity and crop quality. Therefore, efforts must be made to encourage farmers to use fertilizers in a balanced way. Fertilization must take into account the time, type, dose, method, and place. A farmer must know when it's time to do fertilization, the type of fertilizer that is needed by plants, dosage of fertilization, the method of giving, and the location of giving so that the fertilizer given is really beneficial for corn plant.

Fertilizers with the required nutrients, crops, and other chemical inputs, improved irrigation, improved crop varieties, and appropriate agricultural policies have led to the agricultural revolution in various countries (Hazell, 2009; Allen, 2008; Pinstrup-Andersen and Hazell, 1985). Balanced use of chemical (inorganic) fertilizers can be the main driver of land productivity agriculture increased rapidly. The role of fertilizer major role in increasing agricultural yields has been proven and felt by many users.

Based on the description above, the problems formulated for this study are presented in Fig. 1. Furthermore, this study aims to (1) determine the level of farmers' motivation in applying balanced fertilization in maize cultivation, (2) assess factors affecting the level of motivation, (3) develop strategies to increase farmers' motivation, and (4) compare maize plant growth between farmers' habits and the application of balanced fertilization.

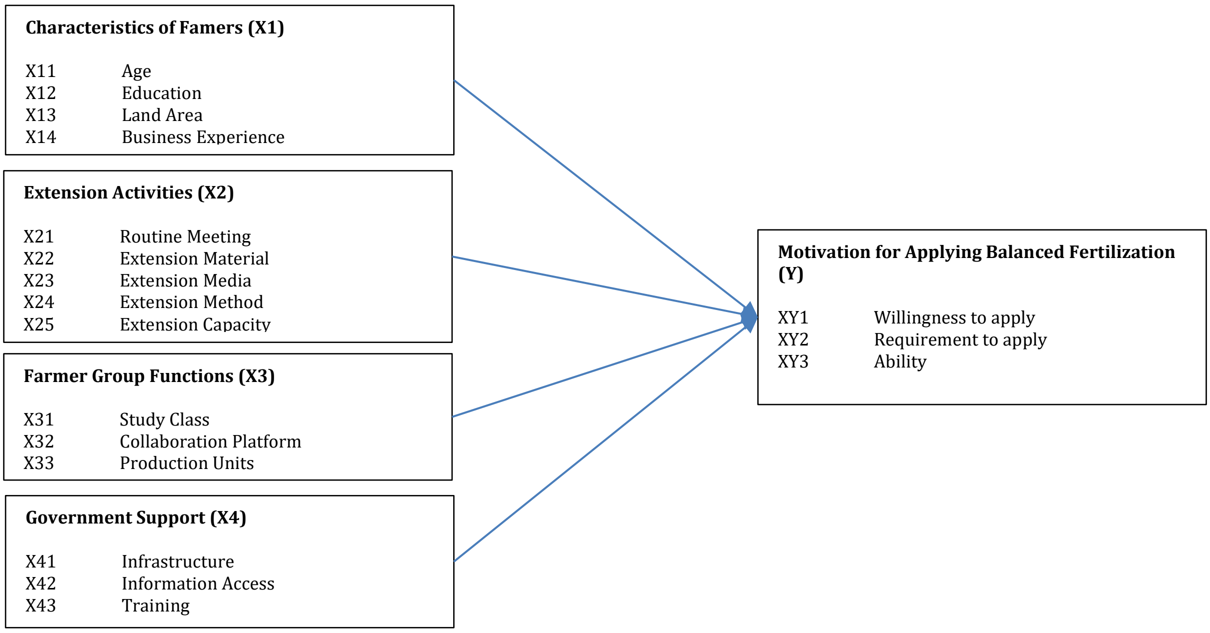


Fig. 1: The framework of farmer group members' motivation in the balanced fertilization application for maize plants

2. Methods

This study was carried out from April to June 2021 in Cengal, Cipicung, and Cieurih Village, Maja District, Majalengka Regency, West Java Province. It was conducted as an explanatory study that examined the effect, or existence of causal relationships. Furthermore, the descriptive quantitative method was used, while data were collected through observation, questionnaires, interviews, and literature studies. The population was 181 farmers carrying out maize cultivation and were members of farmer groups. The sample size of 65 farmer groups was obtained using the Slovin formula approach with an error rate (e) of 10%.

The assessment instrument was a questionnaire that had been tested for validity and reliability. The validity test was carried out with the same characteristics as the assessment respondents, while the reliability was tested using Cronbach's alpha.

Furthermore, data from the respondents were processed using Microsoft Excel for the validity test. The results wherein the value of r-count were greater than r-table (0.533) included 45 items, while 8 others were declared invalid. The Cronbach's alpha value was 0.967 (> 0.60), hence, the instrument tested was declared reliable.

Data were analyzed using descriptive analysis to describe the level of farmers' motivation in applying balanced fertilization. Meanwhile, multiple linear regression analysis was used to determine the factors that affect the farmers' motivation in the application of balanced fertilization with the equation $Y = a + b_1.X_1 + b_2.X_2 + b_3.X_3 + b_4.X_4$, where Y = farmer motivation, X_1 = farmer characteristics, X_2 = socialization activities, X_3 = functions of farmer groups, X_4 = government support, as well as b_1, b_2, b_3, and b_4 = constants. The results of descriptive analysis and multiple linear regression were combined to formulate strategies to increase the motivation in realizing the welfare of farmers. Furthermore, the data were processed using multiple linear regression followed by data transformation from ordinal to interval. The descriptive analysis was used to compare the maize plant growth in the balanced fertilization and farmers' habits treatment group.

The field experiment was conducted as one of the strategies to increase farmers' motivation toward applying balanced fertilization. The experiment was carried out on land owned by farmers who are members of the Windu Subur farmer group in Cipicung Village, Maja District, Majalengka Regency, West Java, in April-July 2021 using maize variety NK 212 and a spacing of 70 cm x 20 cm. A randomized group design was used with 2 treatments and 15 replications on a 20 m x 10 m plot. The first treatment (P0) was the farmer's habit and the second (P1) was the application of balanced fertilization as shown in Table 1. The dosage, time, and method of balanced fertilization were based on the Dry Soil Test Kit (DSTK) including the Leaf Color Chart (LCC) from the SRI (2023). The hypothesis in this study is that there is a significant influence between farmer characteristics, extension activities, function of farmer groups, and government support on the motivation for applying balanced fertilization.

Table 1: Farmer's habit (P0) and balanced fertilization (P1) treatments

No.	Variable	P0 (farmer habit)	P1 (balanced fertilization)
1.	Dose of urea (kg/ha)	400	300
2.	NPK Phonska 15-15-15 dosage	100	300
3.	First fertilization (10 HST)	Urea 100 kg/ha and NPK 100 kg/ha	Urea 50 kg/ha and NPK 300 kg/ha
4.	Second fertilization (35 HST)	Urea 300 kg/ha	Urea 250 kg/ha
5.	Fertilization method	Spread on the soil surface near the plant row	Immersed in the furrow about 10 cm from the plant row

3. Results

3.1. Description of respondent characteristics

Farmers' age affects their work productivity and roles in decision-making from various work alternatives and problems. Based on the age distribution, most respondents were middle-aged, with the age range of 33-48 years in 29 people or 44.62% as shown in Table 2. This condition indicates that most respondents are of productive age hence, their physical condition is quite good and they can carry out various farming activities properly.

Table 2: Characteristics of respondents

Characteristics	Category	Number (people)	Percentage (%)
Age (Year)	Young (15-32)	7	10.76
	Middle-aged (33-48)	29	44.62
	Old (49-64)	16	24.62
	Elderly (>65)	13	20
Total		65	100
Education level (Years)	Elementary school/equivalent (0-6)	38	58.46
	Junior High school/equivalent (7-9)	20	30.75
	Senior high school/equivalent (10-12)	5	7.69
	Higher education (>13)	2	3.1
Total		65	100
Length of farming business (Years)	Less experienced (<10)	7	10.77
	Quite experienced (11-20)	11	16.93
	Experienced (21-30)	26	40
	Very experienced (>30)	21	32.30
Total		65	100
Land Ownership Area (Ha)	Farm laborer (Landless)	7	10.77
	Narrow (<0.5)	42	64.62
	Medium (0.5-2)	15	23.07
	Large (>2)	1	1.54
Total		65	100

The results are consistent with Haryanto et al., (2022) and Asngari et al., (2006) who mentioned that farmers who have good physical abilities are generally in their productive age range. At this age, people are usually relatively productive in working and seeking opportunities or information favorable for improving welfare and self-prestige, which ultimately gives them a sense of satisfaction with success. Good physical condition enables farmers to optimize and develop their farming abilities.

Education is also a crucial factor in improving the quality of human resources, intellectual quality, and one's insight. Therefore, farmer education can be useful in managing their farming business. Based on the level of education, most respondents namely 38 or 58.46% only received education up to elementary school level, while those with a junior, senior, or high school education level were 20 or 30.75%, 5 or 7.69%, and 2 or 3.1%. The results are in line with Alonge et al. (2014), who revealed that education is related to individual independence. Other studies also showed that education affects a person's ability to carry out a job (Fatchiya, 2010) Therefore, it can be concluded that education plays a significant role in shaping a person's thinking and action appropriate to their capacity and becomes the basis for farmers to decide whether to apply balanced fertilization or follow the normal habit.

The majority of the respondents namely 26 or 40% have been farming for 21-30 years, followed by >30 years in 21 or 32.30%, 10-20 years in 11 or 16.93%, and <10 years in 7 or 10.77%. This shows that most respondents already have enough experience in maize farming. According to Manyamsari and Mujiburrahmad (2014), farming experience plays an important role in improving farmers' competencies. Farmers with high experience are usually more mature in dealing with various farming problems.

3.2. Socialization activities

Table 3 shows that all socialization indicators, such as meeting routines as well as materials, media, methods, and capacity of officers, are categorized as low. Regarding the routine meeting indicator, 36 people, or 55.4% were in a low category. These individuals stated that routine meetings for socialization activities were rarely held. Usually, meetings are only held when there is a program in the farmer group. A total of 47 respondents or 72.3% were in the low category for the socialization materials indicator.

Table 3: Socialization activities

Indicators	Category	N (People)	Percentage (%)
Meeting routine	Low	36	55.4
Socialization material	Low	47	72.3
Socialization media	Low	64	98.0
Socialization method	Low	48	73.8
Socialization capacity	Low	36	55.3

According to the respondents, the material presented was still lacking or did not meet farmers' information needs. Indicators of socialization media were also classified as low in 64 people or 98.0%. These respondents mentioned that the media used was still very lacking, as socialization officers rarely use print and electronic media. Indicators of socialization methods were also low in 48 people or 73.8%.

Most respondents have a land area in the narrow category <0.5 ha, namely 42 people or 64.62%, followed by 0.5-2 ha land for 15 or 23.07%, no land (farm laborers) for 7 or 10.77%, and >2 ha only for 1 farmer or 1.54%. This is in line with the farmers' low-income level because they only own a small land area. Hulyatussyamsiah et al. (2019) stated that land is a very important production factor affecting both commodities and agricultural production. The narrower the farmer's land, the lower the value of farming in groups and participation in community activities and vice versa (Nxumalo and Oladele, 2013). Therefore, the decision to use balanced fertilization is also strongly affected by the size of the farmer's land.

The respondents stated that the methods used by socialization officers were not optimal and not appropriate to the needs of farmers. In general, the methods used are only visits, dialogue, as well as question and answer. The indicator of the socialization officers' capacity is low, as indicated by 36 people or 55.3%. The respondents reported that the socialization officers' capacity to master and deliver materials was still not good. However, the communication between the officers and farmers is relatively good.

3.3. Farmer group function

Table 4 shows that all indicators of farmer group functions, such as learning class, cooperation media, and production unit, are low. Learning class indicators are low, as indicated by 48 people or 73.5%. This indicator explains why farmer groups are open to sharing agricultural information, both new technology and the price of agricultural commodities in the market. The indicator of the cooperation media was also classified as low by 43 people or 66.2%. This shows that farmer groups have not worked well together in land management, division of tasks, financial management, and problem-solving. The production unit indicator was also low, as indicated by 46 people or 70.7%. The respondents stated that farmer group production units provide opportunities for each member to cultivate group land, obtain seeds, seedlings, fertilizers, access irrigation, and accommodate production results but this opportunity has not been fully utilized.

Table 4: Functions of farmer groups

Indicators	Category	N (People)	Percentage (%)
Classroom learning	Low	48	73.5
Cooperation media	Low	43	66.2
Production unit	Low	46	70.7

3.4. Government support

Table 5 shows that agricultural facilities and infrastructure indicators were categorized as medium, access to information was high, and training was low. The indicator of agricultural facilities and infrastructure was medium, according to 41 or 63.1% of the respondents. These respondents did not find it difficult to obtain tools and materials in maize farming in the Maja district. The access to information indicator was reportedly high, as indicated by 58 people or 89.3%. The respondents generally find it quite easy to obtain information about farming. The information is usually sourced from socialization officers or other farmers who have successfully cultivated maize in the Maja district. Furthermore, the training indicator is low, as indicated by 39 or 60% of the respondents. The respondents stated training available for farmers such as field schools is insufficient. According to the farmers, training organized by socialization officers is not evenly distributed throughout the district, this is in line with research by Haryanto et al. (2023).

Table 5: Government Support

Indicators	Category	N (People)	Percentage (%)
Agricultural facilities and infrastructure	Medium	41	63.1
Access to information	High	58	89.3
Training	Low	39	60.0

3.5. Analysis of farmers' motivation level

Table 6 shows that the level of farmers' motivation towards balanced fertilization in maize plants was in the medium category as indicated by 44 people or 67.7%, while only 21, or 32.3% were in the high category. The majority of respondents had a medium level of motivation meaning that farmers in the study area still do not apply balanced fertilization technology to maize plants properly and correctly. This is because most farmers are already accustomed to conventional techniques. Nevertheless, there are still enough opportunities to increase maize productivity by improving farmers' motivation to apply balanced fertilization.

Table 6: Descriptive analysis of farmers' motivation level

Criteria	N (People)	Percentage (%)
Low	0	0.0
Medium	44	67.7
High	21	32.3
Total	65	100

3.6. Factors affecting farmers' motivation levels

Based on the regression analysis results presented in Table 7, the variables that had a real effect on the level of farmers' motivation were found to have a significant value of <0.05. These variables include the function of farmer groups (X_3) and government support (X_4) with a significance value of 0.004 and 0.001 respectively. Meanwhile, the variable characteristics of farmers (X_1), with a significance value of -0.102, and socialization activities (X_2) with 0.117 have no real effect. The effect analysis results of factors X_1, X_2, X_3 and X_4 on Y is based on the equation:

$$Y = (1.398) - (0.21)X_1 + (0.182)X_2 + (0.319)X_3 + (0.394)X_4$$

The regression equation shows that the coefficient value b_3 (0.319) implies a real relationship between the function of farmer groups (X_3) and the level of farmers' motivation (Y). This means that when government support (X_4) is constant, then every 1 unit rise in the function of farmer groups (X_3) will increase the level of motivation (Y) by 0.319 units. Similarly, the coefficient b_4 (0.394) explains the relationship between government support (X_4) and the level of motivation (Y). This means that when the function of farmer groups (X_3) is constant, then any rise in the value of government support (X_4) by one unit will increase the level of motivation (Y) by 0.394 units. The independent variables tested, namely farmer characteristics such as age, education, land area, length of farming business; socialization activities including meeting routine, socialization materials, media, methods, and capacity; farmer group functions comprising learning class, cooperation media, production unit, and government support in the form of agricultural infrastructure, access to information, and training significantly affect the motivation of farmers in the application of balanced fertilization (R2 = 0.523). This indicates that the tested variables contribute 52.3% to the motivation of farmers in the application of balanced fertilization, while the remaining 47.7% is affected by other variables. The results of this study differ from those carried out by Ardi and Effendi (2018) which stated that the characteristics of farmers in terms of age, land area, and education significantly affected farming motivation, while in this study the characteristics of farmers did not have an influence but the function of farmer groups and government support did. according to the research of Arga et al. (2021).

3.6.1. Effect of farmer group function on farmer motivation level

The regression test results presented in Table 7 show that farmer group functions significantly affect the motivation to use balanced fertilization in maize, as indicated by a significance value of 0.004 at the 95% confidence level. Furthermore, the positive regression coefficient b_3 = 0.319 means that the higher the value of the farmer group function, the higher the chance of increasing the level of farmers' motivation toward adopting the balanced fertilization of maize plants.

3.6.2. Effect of government support on farmers' motivation level

The regression analysis results presented in Table 7 show that institutional support significantly affects farmer adoption rates, as indicated by a significance value of 0.001 at the 95% confidence level. The positive regression coefficient b_4 of 0.394 also means that the stronger the government support, the higher the chance of increasing the level of farmer motivation toward balanced fertilization application. The government support in this case includes agricultural infrastructure, access to information, and farmer training.

Table 7: Factors influencing farmers' motivation level

Factors	Significance	Effect value	Description
R^2	0.523		
Constant	0.001	1.398	
Farmer characteristics (X_1)	0.102	-0.212	Do not significantly affect
Socialization activities (X_2)	0.117	0.182	Do not significantly affect
Farmer group function (X_3)	0.004	0.319	Significantly affected
Government support (X_4)	0.001	0.394	Significantly affected

3.6.3. Strategies to increase farmer motivation in the application of balanced fertilization

The strategy model, which combines multiple linear regression with descriptive analysis, is presented in Fig. 2. Fig. 2 shows that the farmer group function factor has an effect of 31.9% on the motivation to apply balanced fertilization, while the role of government support contributes 39.4%. Based on the results, the best strategy to increase farmer group members' motivation toward balanced fertilization application in maize farming is through counseling. A descriptive analysis was conducted to select the socialization material from the lowest to the highest indicator value on farmer motivation, the results are presented in Table 8. Table 8 shows that the lowest score of socialization materials is on the ability indicator. This indicates that it is necessary to increase farmers' ability in relation to balanced fertilization application.

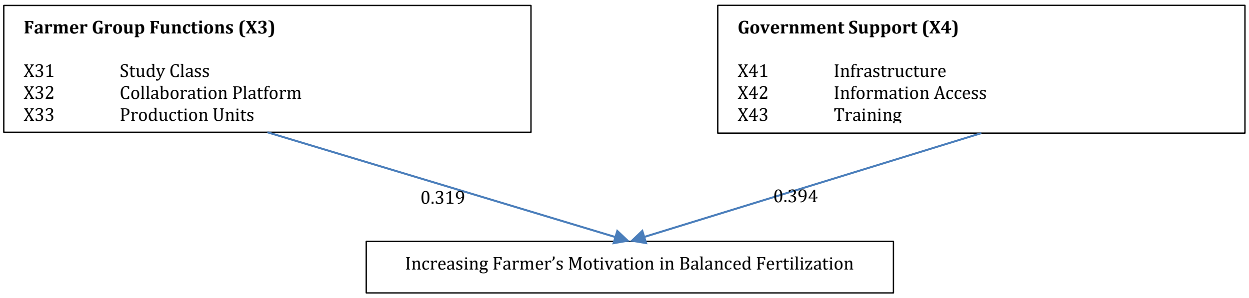


Fig. 2: Strategy model for increasing the motivation of farmer group members in the application of balanced fertilization for maize

Table 8: Descriptive analysis of socialization material indicators

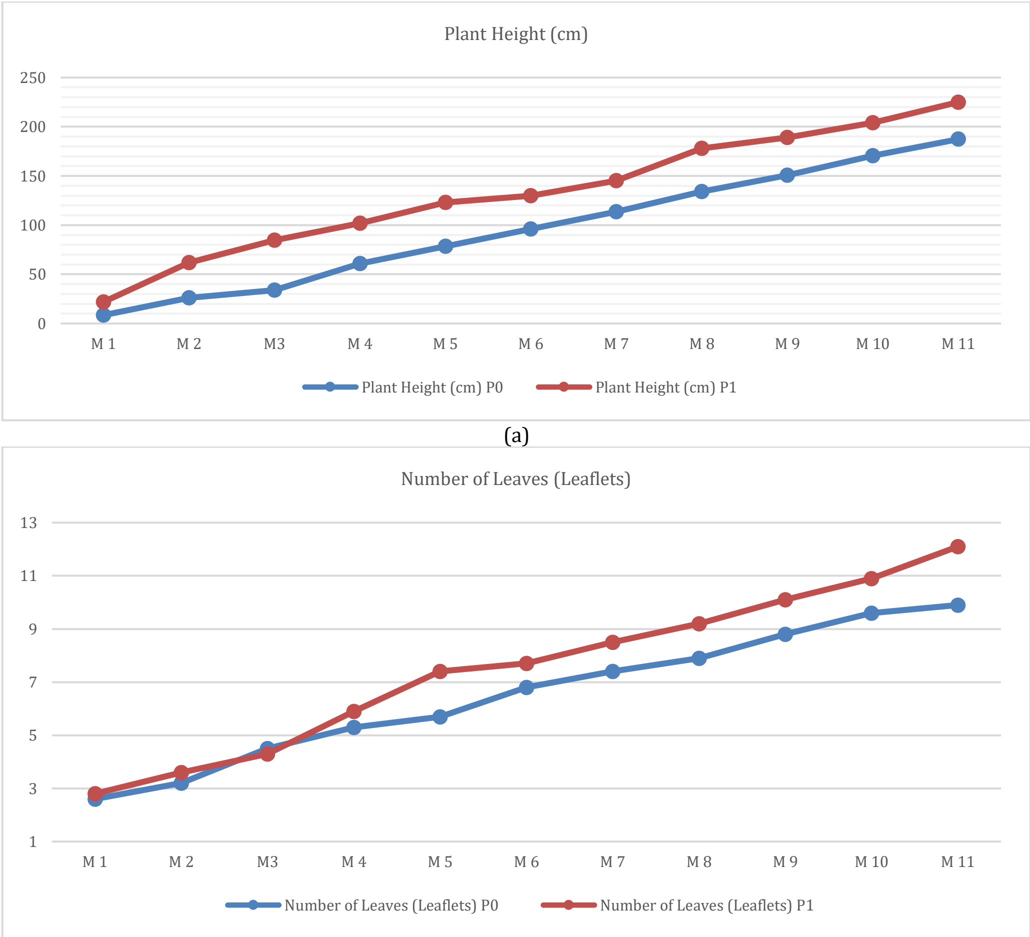
Indicators	Total score	Ranking
Intention	917	III
Needs	877	II
Ability	678	I

3.7. Maize plant growth

The observation results on plant height and number of leaves from the field experiment regarding the application of balanced fertilization are presented in Fig. 3. The P1 curve is always above the P0 curve, both in Fig. 3a (plant height) and Fig. 3b (number of leaves). Moreover, the rise in plant height was also followed by an increase in the number of leaves. This is consistent with Oktem et al. (2010), who stated that plant height could affect the number of leaves. The above phenomena show that the application of balanced fertilization significantly improved plant growth indicated by the height and the number of leaves, compared to farmers' habits. Visually in the field, it also appears that the plant performance in the application of balanced fertilization is better than the farmers' habits. This condition is expected to make farmers more confident in increasing their motivation to apply balanced fertilization. Hulyatussyamsiah et al. (2019) stated that the adoption level of balanced fertilization in Majalengka is mostly still at the persuasion stage. Therefore, the dissemination of balanced fertilization technology still needs to be improved. This confirms that fertilizer is a determining factor in production. Fertilization that is not in accordance with the needs of plants will cause waste in use, and soil damage, and can also trigger disease and certain pest attacks (SRI, 2023).

In line with plant growth, the yield of dry maize kernels and cob+husk from the field experiment also increased due to the application of balanced fertilization compared to farmers' habits as shown in Fig. 4. The application of balanced fertilization increased dry kernels from 11.97 to 13.38 t/ha as well as cob+husk from 2.99 to 3.35 t/ha. Moreover, the total biomass of seeds and cob+husk increased from 14.96 to 16.73 t/ha or by approximately 12%.

Balanced fertilization recommendations for maize at the experimental site based on DSTK include (a) doses of urea and NPK Phonska 15-15-15 of 300 kg/ha each, (b) time of application at 10 HST urea 50 with NPK 100 kg/ha and the rest at 35 HST, as well as (c) method of application buried in the furrow about 10 cm from the plant row. This is different from farmers' habits in terms of dosage, time, and method of fertilizer application. Farmers' habits practice related to maize fertilization include (a) doses of urea and NPK Phonska 15-15-15 of 400 and 100 kg/ha, respectively, (b) time of application at 10 HST urea with NPK of 100 kg/ha each, and the rest at 35 HST, as well as (c) method of application by spreading on the soil surface around the plant rows as shown in Table 1. Differences in the dose, time, and method of fertilizer application caused variations in plant growth and yields.



(b)

Fig. 3: (a) Plant height (cm) and (b) number of leaves (leaflets) in the application of balanced fertilization for maize

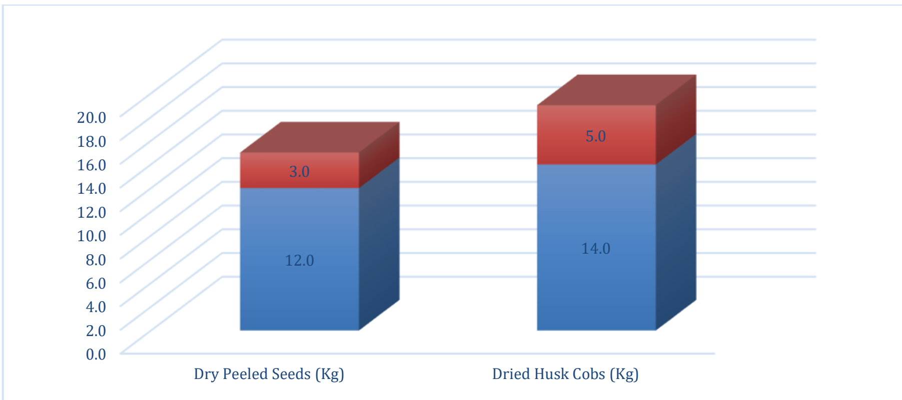


Fig. 4: Yields of dry kernels and dry cob+husk with the application of balanced fertilization for maize (Kg)

The application of N, P, and K fertilizers from urea and NPK fertilizers significantly increased plant growth and yield. The urea at 400 kg/hectare yielded the best growth and production of sweet maize (Li et al., 2017). Furthermore, Sapto Nugroho (2015) found that the application of nitrogen fertilizer at a dose of 250 kg N/ha produced the highest growth effect on plant height parameters, and a dose of 275 kg N/ha gave the highest yield on the components of seed weight per cob and weight of 100 grains at 14% water content. Sutriadi (2017) also reported that K fertilization significantly increased upland rice production in Oxisol Kandik soil. Moreover, NPK fertilization and soil conditioner application increased soybean production (Shamim et al., 2015). Aside from N, P, and K fertilizers are also needed for maize and rice growth both in fields (Kasno and Suastika, 2017), as well as in acidic drylands. Farmers' habit of applying only 100 kg of NPK Phonska 15-15-15, namely 15 kg/ha of P_2O_5 and 15 kg/ha of K_2O equivalent to 40 kg of SP-36 and 25 kg of KCl/ha, is not sufficient for plant needs. The recommended dose of P and K fertilizer from NPK Phonska 15-15-15 of 300 kg/ha is 45 kg/ha P_2O_5 and 45 kg/ha K_2O or equivalent to 120 kg SP-36 and 75 kg KCl/ha. The plant response to N fertilizer depends on the supply of other nutrients, specifically P and K. Without sufficient P and K fertilizers, the plant response to N fertilizer will be lower (Zhang et al., 2023; Xue et al., 2022; Yahaya et al., 2023; Krouk and

Kiba, 2020). Sukristiyonubowo et al. (2016) also mentioned that the balance between P and K nutrients is important, specifically in newly opened fields.

The application of balanced fertilization combined with soil improvements such as using organic fertilizers and compost will provide even better results (Husnain et al, 2016b). Maize plants treated with organic fertilizer produced the best growth in plant height and the number of leaves (Gao et al., 2020). A study conducted by Husnain et al. (2016b) in fields and drylands, obtained similar results, namely the combination of chemical and organic fertilizers significantly increased the yield of food crops.

In general, the application of balanced fertilization requires adherence to 5 rules, namely the right type, dose, time, form/formulation, and method (SRI, 2021), When any of these 5 criteria are not met, fertilization becomes ineffective and inefficient. Farmers' habits, besides inappropriate doses of P and K fertilizers, are also not appropriate. The practice of spreading fertilizers on the soil surface can cause them to be easily lost from the root zone through evaporation and leaching (urea) or washed away with surface water during rainfall (urea and NPK). Therefore, fertilizer should be buried in the furrows near the crop rows to avoid evaporation and drift.

Balanced fertilization provides fertilizer according to plant needs based on the results of local recommendations because it is site-specific. In balanced fertilization, the elements N, P, and K are tested which are macro elements, therefore it is distinguished between using elements N, P, and K according to recommendations and treatments carried out by farmers. This study also confirms that subsidies are related to reduced prices, not related to nutritional content. Balanced fertilization with the addition of organic fertilizer is able to provide the best production response presumably because there are more microorganisms in the soil, and the physical properties of the soil are better than without fertilizer.

4. Conclusion

The motivation of farmer group members towards the application of balanced fertilization in maize (*Zea mays*) cultivation at Maja District is generally in the medium category. The majority of farmers namely 44 or 67.7% belong to the 37-48 medium category, while 21 or 32.3% were in the 25-36 high category, and 0 (0%) belonged to the 12-24 low category. Furthermore, the multiple linear regression analysis on the variables tested showed that farmer groups and government support have a significant effect with a significance value of 0.004 and 0.001 and the value of the effect of 0.319 and 0.394, respectively. The best strategy to increase farmers' motivation in implementing balanced fertilization is by counseling with reference to the lowest indicator value, namely ability. The field experiment results showed that growth, measured by the plant height and the number of leaves, as well as crop yield demonstrated in the dry kernels and dry cob+husk were significantly higher in the balanced fertilization than in the farmers' habits treatment. Based on this, it is necessary to carry out further research related to how balanced fertilization can increase maize production.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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