Evaluation of inorganic fertilization dose of maize hybrid in rainfed lowland Nganjuk East Java

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Abstract. To obtain a recommendation for rational and efficient inorganic fertilizing, a study was conducted in Gejagan village, Loceret, Nganjuk Regency East Java Province from June to November 2016. A randomized block design was used with 3 replications. The type and dose fertilizer were used as atreatment i.e. T1. 850 kg urea + 300 kg NPK Posnka ha⁻¹ (general farmers practise); T2. 650 kg urea + 150 kg ZA + 300 kg ha⁻¹ NPK Ponska (a few farmers practise); T3. 300 kg urea + 300 kg NPK Ponska; T4. 350 kg urea + 325 kg (based on Upland Soil Test Kit + Leaf color chart); T5. 250 kg urea + 325 kg NPK Ponska T6. 450 kg urea + 250 kg NPK Ponska; and T7. 550 kg urea + 250 kg NPK Poska. HJ 21 variety was used as an indicator plant. The treatment significantly affected plant height, stalk diameter and leaf length, cob diameter, kernel weight, net kernel weight and yield. The highest yield was obtained in the T1 and T2. Based on the revenue due to the use of inorganic fertilizers, T4 was more profitable than T1 and recommended as a basis for location-specific fertilizer application.

1. Introduction
Maize is the second most important staple food after rice in Indonesia. To anticipate the increasing of demand, the government is trying to increase national production through various programs and policies such as increasing productivity by providing subsidies for the price of superior seeds and fertilizers, provide various kinds of agricultural machinery for free, assisting cultivation and post-harvest technology, expanding planting areas and limiting imports to increase the enthusiasm of farmers to cultivate maize and maintain domestic price stability.

Several important factors of plant production that affect the productivity of maize, consist of the availability of certified superior seeds, irrigation, maintenance, pest control, and fertilization. The application of adequate quantities of plant nutrients is a key aspect of increasing productivity and production, particularly where farmers use hybrid maize with high yield potential [1]. In line with that, the Ministry of Agriculture has set a general recommendation dose and used as a basis for determining the dose of fertilizer that will receive subsidized prices from the government. General recommended dosages range from 300 kg urea and 200 - 300 kg Ponska NPK or equivalent to 168 – 183 kg N, 30-45 kg P and 30-45 kg K per ha. But in fact that the dose of fertilizer given by farmers in some areas of maize cultivation center is very high and far exceed from the recommended dosage levels, ranges from 400-800 kg urea (300 - 500 kg NPK (185-450 kg N, 45-60 kg P and 45-60 kg K ha⁻¹) (personal communication). Indeed, the recommended fertilizer dose is still general and not site-specific location, because it did not based on the type, properties, and level of soil fertility as well as the
nutrient need of maize. Therefore it was necessary to study location-specific fertilizer doses which were more rational, efficient and economical through a site-specific nutrient management approach.

The concept of fertilizer or site-specific nutrient management (SPNM) is a fertilization approach based on science using rational fertilizers and efficiently under indigenous nutrient supply and plant needs (2). The concept of fertilization is carried out with the target yield approach, namely the application of fertilizers by referring to the balance between nutrients needed by plants, based on the target yields to be achieved with the ability of soil to provide nutrients.

To determine the location-specific fertilizer dosage, besides based on soil analysis in the laboratory, at present, there is a variety of portable and practical soil test equipment, including the Upland Soil Test Kit. In principle, the technology can determine the level of soil nutrients through the soil analysis method in rapid tests [3]. Soil testing is an important tool for preparing site-specific fertilizer recommendations [1].

According to this problem a study was done to obtain site-specific inorganic fertilizer recommendations for rational, efficient and economically fertilizing dose.

2. Material and Methods

The experiment was conducted at Gejagan village, Loceret district, Nganjuk from June to October 2016 (56 m asl). A randomized block design was used with 3 replications. As a treatment was the dose and type of fertilizer as follows: T1. 850 kg urea + 300 kg NPK Ponska ha-1 (general farmers practise); T2. 650 kg urea + 150 kg ZA + 300 kg ha-1 NPK Ponska (a few farmers practise); T3. 300 kg urea + 300 kg NPK Ponska (Regency Government recommendation); T4. 350 kg urea + 325 kg (based on Upland Soil Test Kit/"USTK"+ Leaf color chart “LCC”) T5. 250 kg urea + 325 kg (USTK - 100 kg urea) T6. 450 kg urea + 250 kg NPK Ponska (USTK + 100 kg urea; - 75 kg NPK Ponska) and T7. 550 kg urea + 250 kg NPK Poska (USTK + 200 kg urea; - 75 kg Ponska). The total nutrient content of each treatment was presented in Table 1. As indicator plants were used HJ 21 hybrid maize varieties.

### Table 1. Total nutrient content of each treatment

| Code | Treatments (kg ha\(^{-1}\)) | Total of each nutrient content (kg) | N  | P\(_2\)O\(_5\) | K\(_2\)O | S  |
|------|----------------------------|----------------------------------|----|-------------|--------|----|
| T1   | 850 urea + 300 NPK (general farmers practise ) | 436.00 | 45.00 | 45.00 | 30 |
| T2   | 650 urea + 150 ZA + 300 NPK (few farmers practise ) | 375.50 | 45.00 | 45.00 | 66.00 |
| T3   | 300 urea + 200 NPK (Regency government recommendation) | 168.00 | 30.00 | 30.00 | 20 |
| T4   | 350 urea + 325 NPK (based on USTK+LCC) | 209.75 | 48.75 | 48.75 | 32.5 |
| T5   | 250 urea + 325 NPK | 163.75 | 48.75 | 48.75 | 32.5 |
| T6   | 450 urea + 250 NPK | 255.75 | 37.50 | 47.50 | 25 |
| T7   | 550 urea + 250 NPK | 301.75 | 37.50 | 37.50 | 25 |

The land was ploughed with hand tractor, then rake to smooth the soil. To avoid water flooding a drainage channel was made between the plots. One grain of maize seed was cultivated in 70 x 20 cm plant spacing range after the land was perforated by a drill as deep as 5 cm. Fertilization was carried out three times, first when the plants were 15 days after planting (DAP) that consisting of 1/3 dose of urea and 1/3 dose of NPK according to treatment. Second fertilizing was done at 30 DAP that consisting of the remaining of NPK. The remaining urea was given at 45 DAP planting depend on leaf color chart. ZA fertilizer was also given in 45 DAP. Plant maintenance was carried out by general cultivation instructions and depend on the crop condition.

Data collected included plant growth, harvest yield and yield components, and farming analysis. The analysis of soil nutrients was carried out before planting. Analysis of variance and Duncan's Multiple Test (DMRT) at 5% level was done after the data obtained were tabulated.
3. Result and Discussion

3.1. Condition of location

The assessment site was placed in the lowland and wet climate. In 2016 the rainfall reached 2,766 mm/year with 127 rainy days and there was a rainy day in every month. The average of temperature about 23°C - 28°C with humidity 70 – 80% [4]. The land used for the experiment classified as grumosol soil with a clay texture. The result of the analysis with the Upland Soil Test Kit showed that the soil nutrients had a low N and C-organic, moderate K and high P content with a medium acid pH.

3.2. Plant growth

Analyses of varians of agronomic and yield parameters showed that some parameters was significantly affected by the treatment, except leaf diameter, cob length, cob diameter, cob weight and 100 kernel weight (Table 2).

| Parameter            | Source of Variation | DF | Sum of squares | Means squares | F    | Sig.  |
|----------------------|---------------------|----|----------------|---------------|------|-------|
| Plant height (cm)    | Blocks              | 2  | 100.4657378   | 50.2328869    | 1.456308736 | 0.022827 |
|                      | Between groups      | 6  | 792.65625     | 132.109375    | 3.83000647 | 0.022827 |
|                      | Within groups       | 12 | 413.9196429   | 34.4933057    |       |       |
|                      | Total               | 20 | 1307.041667   | 65.3520833    |       |       |
| Stalk diameter (cm)  | Blocks              | 2  | 0.220238005   | 0.110119048   | 2.70731703 | 0.099616 |
|                      | Between groups      | 6  | 0.976190476   | 0.162698413   | 4     | 0.0199616 |
|                      | Within groups       | 12 | 0.488095238   | 0.040674603   |       |       |
|                      | Total               | 20 | 1.68452381    | 0.083621691   |       |       |
| Leaf length (cm)     | Blocks              | 2  | 2.36395238    | 1.181547619   | 0.070128952 | 0.040573 |
|                      | Between groups      | 6  | 324.4107143   | 54.06845238   | 3.209150327 | 0.040573 |
|                      | Within groups       | 12 | 202.1785714   | 16.8421429    |       |       |
|                      | Total               | 20 | 528.952381    | 26.44761305   |       |       |
| Leaf diameter (cm)   | Blocks              | 2  | 0.337380952   | 0.168609476   | 0.214699681 | 0.913182 |
|                      | Between groups      | 6  | 1.516190476   | 0.252698413   | 0.321620222 | 0.913182 |
|                      | Within groups       | 12 | 9.428452381   | 0.785704365   |       |       |
|                      | Total               | 20 | 11.28202381   | 0.56410119    |       |       |
| Cob length (cm)      | Blocks              | 2  | 5.311090476   | 0.858198413   | 1.039258926 | 0.447196 |
|                      | Between groups      | 6  | 10.2211111    | 1.6878307    | 4.614258912 | 0.084335 |
|                      | Within groups       | 12 | 26.32637566   | 4.16318783    |       |       |
|                      | Total               | 20 | 43.95882381   | 6.52513051    |       |       |
| Cob diameter (cm)    | Blocks              | 2  | 0.433756614   | 0.216873807   | 1.02847166 | 0.040573 |
|                      | Between groups      | 6  | 0.701931217   | 0.116988556   | 2.48002439 | 0.084335 |
|                      | Within groups       | 12 | 0.564021164   | 0.047001764   |       |       |
|                      | Total               | 20 | 1.699708955   | 0.08949545    |       |       |
| Cob weight (g)       | Blocks              | 2  | 3602.952381   | 1801.47619    | 2.978481766 | 0.040573 |
|                      | Between groups      | 6  | 3651.892857   | 608.6848095   | 1.006313202 | 0.467482 |
|                      | Within groups       | 12 | 7257.964286   | 604.8303571   |       |       |
|                      | Total               | 20 | 14512.80952   | 725.6407462   |       |       |
| Kernel weight/cob (g)| Blocks              | 2  | 1258.849767   | 629.4248836   | 3.482636857 | 0.042867 |
|                      | Between groups      | 6  | 3428.444906   | 571.4074844   | 3.161623916 | 0.042867 |
|                      | Within groups       | 12 | 2168.787305   | 180.7322754   |       |       |
|                      | Total               | 20 | 6856.081979   | 342.8040989   |       |       |
| Net kernel weight    | Blocks              | 2  | 0.091485711   | 0.000748558   | 0.484100268 | 0.030169 |
|                      | Between groups      | 6  | 0.03521813    | 0.005419688   | 3.522392009 | 0.030169 |
|                      | Within groups       | 12 | 0.018463663   | 0.001538539   |       |       |
|                      | Total               | 20 | 0.052471504   | 0.002623575   |       |       |
| 100 kernel weight (g)| Blocks              | 2  | 6.245754721   | 3.122877376   | 0.532636593 | 0.030169 |
|                      | Between groups      | 6  | 30.93620966   | 5.156034943   | 0.878962798 | 0.538311 |
|                      | Within groups       | 12 | 70.39235478   | 5.860445655   |       |       |
|                      | Total               | 20 | 107.544992    | 5.378724958   |       |       |
| Sampling Yield       | Blocks              | 2  | 2.023890519    | 1.01294526    | 1.124907235 | 0.099633 |
|                      | Between groups      | 6  | 16.22753831    | 2.70589719    | 3.003513053 | 0.099633 |
|                      | Within groups       | 12 | 10.80564045    | 0.900470037   |       |       |
|                      | Total               | 20 | 29.05909728    | 1.452953464   |       |       |
| Yeld (ton)           | Blocks              | 2  | 0.79100011    | 0.395900555   | 1.067277111 | 0.004533 |
|                      | Between groups      | 6  | 13.11361843    | 2.185630732    | 5.898961589 | 0.004533 |
|                      | Within groups       | 12 | 4.446830734    | 0.370596228    |       |       |
|                      | Total               | 20 | 18.35144927   | 0.917572464   |       |       |

Observation of plant growth, especially plant height showed a significant difference in the effect of the treatments tested. The highest plant posture was obtained at T2 treatment reaching 208.75 cm and significantly different from T3 and T5 (Table 3). This result were consistent the other reseach that the
differential dosage of N, P and K fertilizer significantly affected the height of maize plants. The highest plant posture was obtained in fertilizing 500 kg urea + 350 kg TSP + 300 kg/ha KCl [5]. Other study showed that increasing the NPK fertilizer dose to 300 kg/ha + 250 kg Urea significantly increased plant height compared to the dose of 50 kg/ha. However, increasing the dose to 400 kg/ha + 250 kg of urea did not increase plant height [6]. Different result was reported that the application of fertilizer with urea as much as 100 kg + NPK compound fertilizer between 300-600 kg ha\(^{-1}\) kg significantly affected plant growth with the response equivalent to N, P, K fertilizers single soil test [7].

### Table 3. Effect of fertilizer treatment application to maize growth in lowland

| Code | Treatments (kg ha\(^{-1}\)) | Plant height (cm) | Stalk diameter (cm) | Leaf length (cm) | Leaf diameter (cm) |
|------|-------------------------------|-------------------|---------------------|------------------|-------------------|
| T1   | 850 urea + 300 NPK (general farmers practise) | 203.96 ab         | 2.58 b              | 87.83 c          | 9.11 a            |
| T2   | 650 urea + 150 ZA + 300 NPK (few farmers practise) | 208.75 a          | 2.75 b              | 91.58 bc         | 9.75 a            |
| T3   | 300 urea + 300 NPK (Regency government recommendation) | 189.58 c          | 2.92 ab             | 96.46 ab         | 9.63 a            |
| T4   | 350 urea + 325 NPK (based on USTK +LCC) | 202.33 ab         | 2.92 ab             | 100.08 a         | 9.63 a            |
| T5   | 250 urea + 325 NPK | 192.58 bc         | 3.25 a              | 96.75 ab         | 9.50 a            |
| T6   | 450 urea + 250 NPK | 198.25 abc        | 2.92 ab             | 95.50 ab         | 9.25 a            |
| T7   | 550 urea + 250 NPK | 197.25 abc        | 2.58 b              | 98.75 ab         | 9.96 a            |
| CV   |                               | 2.95              | 7.08                | 4.23             | 9.28              |
| SEM  |                               | 3.39              | 0.11                | 4.0              | 0.51              |

Stalk diameter also significantly affected by fertilizers treatment. The same result was reported that the use of a high dose of fertilizer about 900 kg ha\(^{-1}\) Urea and 600 kg ha\(^{-1}\) NPK Phonska on non IPM applications can increase the growth of maize stalk [8].

Observation of leaf length showed that the longest leaf was obtained in the T4 treatment with a length reaching 100 cm and significantly different from the T1 treatment despite receiving the highest intake of N elements among all treatments. This finding indicates that the increase in leaf length was not only influenced by N elements, but also by other nutrients such as P, K, and S.

### 3.3. Grain Yield

Observation of yield components showed significant differences effect only in the diameter of the cobs, kernel weight per cob and net kernel weight (Table 4). The biggest cob was obtained in T2 and T7 with diameters of 4.96 and 4.88 cm and significantly different from treatments of T5 with a diameter of only 4.04 cm.

Observation of kernel weight per cob showed that the heaviest kernel were obtained in the T2 treatment and significantly different from the T3, T4, T 5, T6 and T7 treatment. Thus the treatment of fertilizers with a dominant combination N can increase kernel weight.

Observation of net grain weight which is a comparison of seed weight to the weight per cob showed that fertilizer treatment has a significant effect on net grain weight. The highest net grain weight obtained in the T7 treatment reached a value of 0.74, while the net grain weight in the other treatment only ranged from 0.61 to 0.67. The diameter of the cobs influences the production of maize because the larger the diameter of the cobs, the maize will get heavier. The diameter of the cob is also affected by the size and weight of the seeds. Increased seed weight is supposed to be closely related to the amount of photosynthate that partitioned into the cob. The greater the photosynthate that allocated to the cobs, thus the accumulation of food reserves increase that are transplanted to seeds, thus the weight of the seeds increases. But on the contrary, the reduced photosynthate allocated to the cob causes the accumulation of food reserves to decrease that are transplanted to seeds, therefore the weight of the seeds decreases [9].
### Table 4. Effect of fertilizer treatment application to harvest yield component of maize in lowland

| Code | Treatments (kg ha\(^{-1}\)) | Cob length (cm) | Cob diameter (cm) | Kernel weight/cob (cm) | Net kernel weight (%) | 100 kernel weight (g) |
|------|-------------------------------|-----------------|-------------------|-----------------------|----------------------|-----------------------|
| T1   | 850 urea + 300 NPK (general farmers practise) | 19.04 a | 4.76 ab | 155.15 ab | 0.66 abc | 33.28 a |
| T2   | 650 urea + 150 ZA + 300 NPK (few farmers practise) | 18.30 a | 4.96 a | 170.70 a | 0.74 a | 34.81 a |
| T3   | 300 urea + 300 NPK (Regency government recommendation) | 18.39 a | 4.63 ab | 133.25 b | 0.67 abc | 31.40 a |
| T4   | 350 urea + 325 NPK (based on USTK + LCC) | 19.04 a | 4.73 ab | 151.57 ab | 0.69 ab | 33.44 a |
| T5   | 250 urea + 325 NPK | 17.45 a | 4.04 b | 130.35 b | 0.61 c | 31.21 a |
| T6   | 450 urea + 250 NPK | 18.47 a | 4.72 ab | 142.64 b | 0.62 bc | 33.00 a |
| T7   | 550 urea + 250 NPK | 18.22 a | 4.88 a | 144.07 b | 0.66 bc | 31.73 a |
| CV   |                               |                |                  |                       | 5.01 |                           |
| SEM  |                               |                |                  |                       | 0.53 |                           |

### Table 5. Effect of fertilizer treatments to harvest yield of maize in lowland

| Code | Treatments (kg ha\(^{-1}\)) | Harvest sampling plot yield (kg/7.5 m\(^2\)) | Yield (ton ha\(^{-1}\)) | △ yield of treatment to T1 (%) | △ yield of treatment to T2 (%) |
|------|-------------------------------|-----------------------------------------------|--------------------------|--------------------------------|--------------------------------|
| T1   | 850 urea + 300 NPK (general farmers practise) | 11.64 ab | 8.70 a | -5.16 |                |
| T2   | 650 urea + 150 ZA + 300 NPK (few farmers practise) | 12.89 a | 9.17 a | 5.44 |                |
| T3   | 300 urea + 300 NPK (Regency government recommendation) | 10.56 b | 7.51 b | -13.66 | -18.11 |
| T4   | 350 urea + 325 NPK (based on USTK + LCC) | 10.85 b | 8.52 ab | -2.12 | -7.17 |
| T5   | 250 urea + 325 NPK | 9.87 b | 7.35 b | -15.57 | -19.92 |
| T6   | 450 urea + 250 NPK | 11.06 b | 8.29 ab | -2.617 | -9.60 |
| T7   | 550 urea + 250 NPK | 11.40 ab | 8.24 ab | -5.247 | -10.14 |
| CV   |                               | 8.45 | 7.33 |                |
| SEM  |                               | 0.54 | 0.35 |                |

The treatments tested also had a significant effect on the sampling result. The highest yield per plot was obtained from T2 treatments about 12.89 kg respectively, and significantly different from T3, T4, T5 and T6 treatments with yield weight about 10.56, 10.85, 9.87 and 11.06 kg respectively (Table 5). Observation of the total yield showed that there are significant differences between the tested treatments. The highest yields obtained in the treatment of T2 reached 9.17 kg/ha and were not significantly different from T1, T4, T6, and T7 with yield weights of 8.70, 8.51, 8.29 and 8.24 tons ha\(^{-1}\) respectively. If observed further, the yield in the T2 treatment was obtained with the addition of fertilizer equivalent to 375.50 kg N, 45.00 kg P, 45.00 kg K and 66.00 kg S. Different result was reported that fertilizing 180 kg N + 90 kg P\(_2\)O\(_5\) + 60 kg K\(_2\)O in the incepticoll of Bone field produces dry corn of 8.72 tons ha\(^{-1}\) [12]. This was in line with another reported that the application of complete compound fertilizer significantly increases the dry weight of corn kernels. The highest dry weight of corn seeds was achieved at 300 kg/ha of NPK + 250 kg of urea compared to lower doses. Increasing the NPK fertilizer dosage to 400 kg/ha + 250 kg of urea does not increase the dry grain weight of corn seeds compared to the 300 kg/ha + 250 kg of urea. The optimum dose of NPK 15-15-15 for maize plants is 300 kg/ha + 250 kg urea/ha with the dry shell weight of corn seeds 6.05 tons ha\(^{-1}\) [6].
Research in Majalengka paddy fields showed that the most optimum fertilizer dosage was 250 kg NPK and 200 kg urea with yields reaching 9.00 tons ha\(^{-1}\) [10]. Tuherkih and Sipahutar (2010) reported that the optimal dose was found at a dose of 450 kg ha\(^{-1}\) + 100 kg urea which produced 9.0 tons ha\(^{-1}\) of dried grains with RAE 95.12% equivalent to the standard N, P, K fertilizer [7]. Besides, the high weight of seed yield in the T2 treatment is also thought to be influenced by the element S contained in ZA fertilizer. The corn plants that are given additional treatment S obtained from ZA can significantly increase the weight of seed production and the highest number of seeds. This may be because ZA fertilizer provides sulphur in the form of sulphate (SO\(_4^{2-}\)) hence the plants can absorb sulphate directly and use it in the process of seed growth [11].

### 3.4. Farming analysis

A simple farming analysis was done by calculating the total cost of fertilizer and yield, which refers to the price at the farm level at the time the research was conducted. The price of urea fertilizer was Rp 1,800 / kg, NPK Ponska Rp 2,300 / kg and ZA Rp 2000 / kg. The price of dry maize at the farm level is Rp 3,200 / kg.

The result of the farming analysis showed that the highest costs for purchasing inorganic fertilizers were found in the T1 treatment reaching Rp 2,220,000 and the lowest cost was in the T5 treatment only Rp 1,197,500. If all other fertilizer treatments compared with T1 which was generally practised by farmers, then the most efficient cost for purchasing the fertilizer was obtained at T5 treatment reaches 46%. However, the lowest income at T5 only reached Rp 22,322,500 while the highest income obtained at T2 treatment reached Rp 27,274,000.

#### Tabel 6. Analysis of inorganic fertilizers cost and their efficiency on some maize fertilization methods

| Code | Treatments (kg/ha) | Cost of inorganic fertilizer per items (Rp/ha) | Total cost of inorganic fertilizer (Rp/ha) | ∆ Total cost of organic fertilizer method to existing 1 (Rp/ha) | Total cost of organic fertilizer method to existing 2 (Rp/ha) | % Cost efficiency of inorganic fertilizer methods to existing 1 | % Cost efficiency of inorganic fertilizer methods to existing 2 | Total yield (kg/ha) | Revenue (Rp/ha) | ∆ Revenue - total cost of organic fertilizer (Rp/ha) | ∆ Revenue - total cost of inorganic fertilizer method to existing 1 (Rp/ha) | ∆ Revenue - total cost of inorganic fertilizer method to existing 2 (Rp/ha) |
|------|-------------------|-----------------------------------------------|-------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------|----------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| T1   | 850 urea + 300 NPK (general farmers practice) | 1,530,000 / 690,000 | 2,220,000 / 0 | 150,000 / 0 | 7.25 / 8.69 | 27,840,000 / 25,620,000 | 0 / 0 | 1,654,000 | 29,344,000 | 22,724,000 | 1,820,000 / 24,803,000 | 0 / 0 | 1,164,000 / 1,654,000 |
| T2   | 650 urea + 150 ZA NPK (few farmers practice) | 1,170,000 / 680,000 | 2,070,000 / -150,000 | 0 / -6.76 | 0.00 / 9.17 | 29,344,000 / 22,724,000 | 1,654,000 / 0 | 0 | 2,818,000 | 24,032,000 | -3,297,500 / -2,472,000 | 0 / 0 | 24,803,000 / 24,032,000 |
| T3   | 300 urea + 300 NPK (Regency government recommendation) | 540,000 / 600,000 | 1,230,000 / -990,000 | -840,000 / -44.59 | 0 / 40.58 | 7.51 / 24,032,000 | 22,802,000 / 22,802,000 | -1,022,500 | 25,620,000 | 24,803,000 | -2,818,000 / -2,472,000 | 0 / 0 | 3,297,500 / 3,297,500 |
| T4   | 350 urea + 325 NPK (based on USTK + LCC) | 630,000 / 747,500 | 1,377,500 / -842,500 | -692,500 / -37.95 | 0 / 40.70 | 8.51 / 27,840,000 | 25,620,000 / 25,854,500 | -835,000 | 24,032,000 | 24,803,000 | -1,419,500 / -1,419,500 | 0 / 0 | 2,818,000 / 2,818,000 |
| T5   | 250 urea + 325 NPK | 450,000 / 747,500 | 1,197,500 / -1,022,500 | -872,500 / -46.06 | -42.15 / 7.35 | 23,520,000 / 22,802,000 | 22,802,000 / 22,802,000 | -835,000 | 24,032,000 | 24,803,000 | -1,419,500 / -1,419,500 | 0 / 0 | 2,818,000 / 2,818,000 |
| T6   | 450 urea + 250 NPK | 810,000 / 575,000 | 1,385,000 / -835,000 | -685,000 / -37.61 | -33.09 / 8.29 | 26,328,000 / 25,143,000 | 25,143,000 / 25,143,000 | -835,000 | 24,032,000 | 24,803,000 | -1,419,500 / -1,419,500 | 0 / 0 | 2,818,000 / 2,818,000 |
| T7   | 550 urea + 250 NPK | 990,000 / 575,000 | 1,565,000 / -655,000 | -505,000 / -29.50 | -24.40 / 8.24 | 26,368,000 / 24,803,000 | 24,803,000 / 24,803,000 | -840,000 | 24,032,000 | 24,803,000 | -1,419,500 / -1,419,500 | 0 / 0 | 2,818,000 / 2,818,000 |

Furthermore, only T4 still provides a profit of Rp. 234,500 with fertilizing cost efficiency of 37.95% when compared to T1. Thus the T4 treatment, whose fertilization dose was based on USTK + LCC, should be recommended as a more rational, efficient and more economical basis for fertilization. Especially considering the T1 and T2 treatments that the dose of fertilizer used especially urea has far exceeded the subsidized dose by the government which is only 300 kg urea + 300 kg/ha NPK Ponska as in the T3 treatment. If observed further, the yield in the T2 treatment was obtained with the addition of fertilizer equivalent to 375.50 kg N, 45.00 kg P, 45.00 kg K and 66.00 kg S. Different result was reported that by fertilizing 180 kg N + 90 kg P2O5 + 60 kg K2O in the inceptocol of Bone field produces dry maize of 8.72 tons ha\(^{-1}\) [12]. This was in line with the other study that the application of complete compound fertilizer significantly increases the dry weight of maize kernels. The highest dry
The dry grain weight of maize seeds was achieved at 300 kg/ha of NPK + 250 kg of urea compared to lower doses. Increasing the NPK fertilizer dosage to 400 kg/ha + 250 kg of urea does not increase the dry grain weight of maize seeds compared to the 300 kg/ha + 250 kg of urea.

4. Conclusion
Fertilizer dose increasing affects the plant growth and yield. The highest yield was found in T2 and T1. However, it was not directly affecting to the farmers income. Fertilizer application based on USTK + LCC (T4) can still provide a profit of Rp 234,500 with fertilizer efficiency of 37.95% compared to fertilizers that are usually done by local farmers (T1). Fertilizer application based on USTK + LCC is recommended as a basis for rational, more efficient and economical location-specific fertilizer application.

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