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A Comparative Study of the Use Urea Fertilizer and Nitrate Fertilizer on Barley Plant Undersand Soil Conditions in the Sirte City

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ABSTRACT: *This study aims to using of Urea fertilizer and Nitrate fertilizer on barley plant under sand soil conditions in the Sirte city. The research was carried out at the Experiment Station, Faculty of Agriculture, Sirte University During the year 2018. The materials used in this study were Barley plant seeds, urea fertilizer, nitrate fertilizer, water, label paper, and other supporting materials. implementation of this research The tools used in this study were hoe, gembor, meter, handsprayer, calculator, scales, planimeter, wire as a bamboo nursery binder and other tools that support the implementation of this research. The first factor is the application of urea (U) and nitrate (N) fertilizers which consist of two levels, namely 5 g/plot and 10 g/plot. The plant parameters observed in the study were plant height (cm), number of leaves (strands), and production per plant (g).*

KEY WORDS:- *Urea fertilizer, Nitrate fertilizer, barley plant, Sirte*

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I. INTRODUCTION

Barley is a grain that belongs to the wheat family of grains. Plants that grow barley are classed as subtropical. The high temperature is one of the reasons restricting its growth. Wheat growth, development, yield, and quality are all influenced by the availability of nutrients from the soil, in addition to temperature. In general, soils in the humid tropics are poor in nutrients, particularly nitrogen, phosphorus, and potassium. As a result, fertilizer is required to fulfill the soil's nutritional requirements. The use of fertilizer is site-specific and depends on the availability of nutrients, organic matter in the soil, and the desired yield.

Fertilizer application, which is focused on maximizing yields, has negative effects in the form of low fertilizer use efficiency, soil nutrient imbalances, and micro element deficiency on certain land. Fertilization must take into account the availability of nutrients in the soil as well as site-specific productivity. Site-specific fertilization at the optimum dose will produce the best outcomes, boost fertilizer application efficiency, and limit fertilization's negative impact. The necessary dosage of inorganic fertilizers and the recommended usage of organic matter addition are combined in proper fertilization.

Proper care and fertilization are one of the ways to boost productivity (Agromedia, 2007). Fertilization can help increase lettuce output. Artificial fertilizers and natural fertilizers can both be used to fertilize the land. Because the nutrients in the soil are not always adequate to drive plant development effectively, fertilization tries to supply nutrients needed by plants (Salikin, 2003). Farmers have always relied on inorganic fertilizers. Inorganic fertilizer use that is quite high and continuous can have a detrimental influence on the soil environment, lowering agricultural land production. This condition gave rise to the idea of re-using organic matter as a source of organic fertilizer. The use of organic fertilizers is able to maintain land balance and increase land productivity and reduce the environmental impact of the soil.

At current time, there are a variety of fertilizers available, each with its own set of ingredients. Urea fertilizer is a single fertilizer that only includes one major ingredient, 42 to 46 percent nitrogen. Plant growth and production, such as plant length, stem diameter, quantity of fruits, and output, are influenced by the percentage and timing of N application (Sebayang, 2004). Nitrate fertilizer is a nitrogen (nitrogen) fertilizer that comes in the form of nitrate ions ($NO3^{–}$). Although nitrogen isn't just found in the form of nitrate ions. Ammonium can also be used as a source of nitrogen for plants. Nitrogen is a nutrient that plants require.

Therefore, based on the explanation above this study aims to use of Urea fertilizer and Nitrate fertilizer on barley plant under sand soil conditions in the sirte city A field experiment was carried out at the Experiment Station, Faculty of Agriculture, Sirte University During the year 2018.

II. LITERATURE REVIEW

Nitrogen

One of the most important elements in achieving excellent wheat yields is nitrogen. Chlorophyll, which helps plants to convert solar energy into glucose, contains nitrogen. Nitrogen is a component of DNA and RNA in every plant cell and has a function in protein production. Plants require the greatest nitrogen, which is frequently low in comparison to other nutrients. Wheat crops, like other cereals, are extremely sensitive to N shortage and respond well to nitrogen fertilizer.

Because nitrogen is mobile in plants, it is transported from old leaves to new leaves at times of low nutrition delivery from the soil, causing signs of nutrient insufficiency to arise in old leaves. Slow growth, weak stems, thin and easy to fall, narrow and short leaves, reduced number of tillers, and low seed output are all signs of N deficiency in wheat plants. Due to insufficient leaf chlorophyll, if there is a lack of N in the early stages of development, the entire leaf surface will be light green or yellowish green. If a N shortage is present during the tillering period, the lower leaves become yellow from the edge to the bone, then turn pale brown before withering and dying. If the N content in the leaves is less than 3.4 percent, wheat plants display indications of nutritional insufficiency (Snowbal and Robson 1991). N deficiency is often found in soils with low organic matter content, sandy texture, high rainfall, high cropping intensity, and flooded plants (Sharma and Kumar 2011).

Excess N can cause wheat plants to collapse readily, making them vulnerable to pests and diseases and resulting in low yields. Furthermore, excessive N fertilization will result in increased N2O and NH3 gas emissions, both of which are harmful to the environment. Wheat plants with optimal N fertilization had more tillers, panicles, panicle length, number of seeds/panicle, seed weight, yield, yield index, and seed protein content (Shahzad et al. 2013, Yousaf et al. 2014).

The amount of nitrogen fertilizer used depends on the amount of nitrogen in the soil, the amount of organic matter present, and the expected yield. Soils with high organic matter content require less N fertilizer than soils with low organic matter content. In soils with >4% organic matter content, wheat plants require 55-80 kg N/ha, in soils with 2-4% organic matter require 80-105 kg N, and if the soil organic matter content is <2%, wheat plants require 105-5%. 130 kg N/ha (Shelley 2014). In general, the dose of N fertilizer for wheat to obtain a yield of 4 t/ha is 80-125 kg N/ha. To produce wheat seeds with high protein content requires relatively more N nutrients than for optimal seed production (Whitney 1997).

Urea Fertilizer

Urea fertilizer is a nitrogen (N) fertilizer with a high nitrogen (N) content of 45 to 56 percent (Fajrin, 2016). The element nitrogen is a nutrient that plants require. Urea fertilizer contains nitrogen, which is extremely useful to plant growth and development. Urea fertilizer makes plant leaves greener, lusher, and fresher, among other things. Nitrogen also aids in the production of a lot of green leaf material in plants (chlorophyll). It will be simpler for plants to carry out photosynthesis in the presence of copious leaf green matter, and urea fertilizer will also promote plant development (height, number of tillers, branches and others). In addition, urea fertilizer is also able to increase the protein content in plants.

This fertilizer is a hygroscopic fertilizer, which means it evaporates more easily in the air. Urea can collect moisture from the air even at 73 percent humidity, making it easily soluble in water and absorbed by plants. Nitrogen in urea must first be transformed to ammonium (N-NH4 +) by the urease enzyme through a hydrolysis process before it can be taken by plants. When delivered to the soil, however, the hydrolysis process occurs swiftly, allowing it to easily escape as ammonia. Distributed urea is rapidly degraded (in 2-4 days) and vulnerable to volatilization loss (Nainggolan, 2010).

Modifying the physical and chemical form of urea fertilizer such that it is expected to slow down the hydrolysis process is one technique to decrease N loss. The production of urea fertilizer in big grain sizes can boost fertilizer availability, allowing it to persist longer, be absorbed by plants, and be lost less than pril urea. Super granular urea and urea briquettes, which are administered by immersion as deep as 15 cm from the top layer, are two examples of novel types of urea (Nainggolan, 2010).

III. METHODOLOGY

The research was carried out at the Experiment Station, Faculty of Agriculture, Sirte University During the year 2018. The materials used in this study were Barley plant seeds, urea fertilizer, nitrate fertilizer, water, label paper, and other supporting materials. implementation of this research The tools used in this study were hoe, gembor, meter, handsprayer, calculator, scales, planimeter, wire as a bamboo nursery binder and other tools that support the implementation of this research.

The first factor is the application of urea (U) and nitrate (N) fertilizers which consist of two levels, namely 5 g/plot and 10 g/plot. The plant parameters observed in the study were plant height (cm), number of leaves (strands), and production per plant (g).

IV. RESULTS

Plant Height (cm)

The results of the average difference test of the effect of urea and nitrate fertilizers on barley plant height can be seen in Table 1 below.

Table 1. The results of the average difference test of the effect of giving urea and nitrate fertilizers on the height of barley plants.

Urea Fertilizer		Nitrate Fertilizer	
Treatment	Plant Height (cm)	Treatment	Plant Height (cm)
U1	14,45	N1	16,59
U2	15,86	N2	17,48
Average	15,155	Average	17,035

From Table 1, it can be seen that the administration of urea fertilizer at a dose of 5 g/plot (U1) had the lowest plant height of 14.45cm, while the administration of urea fertilizer at a dose of 10 g/plot (U2) had a plant height of 15.86 cm. Plant height was greater in the application of Nitrate fertilizer with N1 of 16.59 cm and N2 of 17.48 cm.

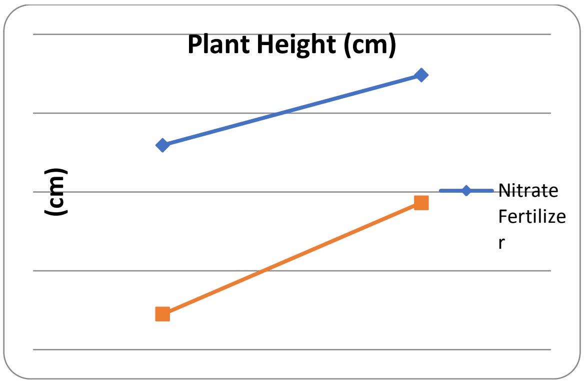

Figure 1. The results of the average difference test of the effect of giving urea and nitrate fertilizers on the height of barley plants.

Number of Leaves (Strand)

The results of the average difference test of the effect of urea and nitrate fertilizers on the number of Barley leaves can be seen in Table 1 below.

Table 2. Test Results of Mean Differences in Effect of Urea Fertilizer and Nitrate Fertilizer on the Number of Leaves of Barley Plants.

Urea Fertilizer		Nitrate Fertilizer	
Treatment	number of leaves (strands)	Treatment	number of leaves (strands)
U1	20,2	N1	20,65
U2	21,15	N2	21,65
Average	20,675	Average	21,15

From Table 2 it can be seen that the administration of urea fertilizer at a dose of 5 g/plot (U1) had the lowest number of leaves, namely 20.2 strands, while the administration of urea fertilizer at a dose of 10 g/plot (U2) had the number of leaves of 21.15 strands. The number of leaves was greater in the application of Nitrate fertilizer with N1 of 20.65 strands and N2 of 21.65 strands.

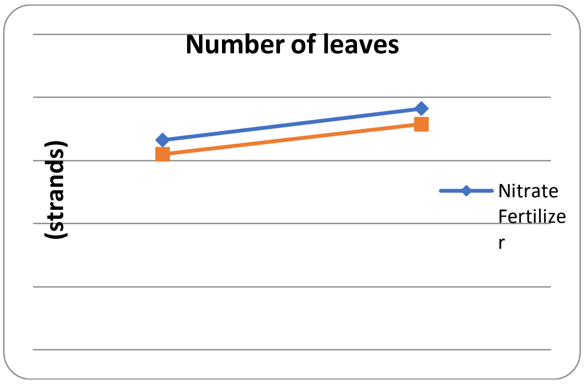

Figure 2. Test Results of Mean Differences in Effect of Urea Fertilizer and Nitrate Fertilizer on the Number of Leaves of Barley Plants.

Production Per Plant (g)

The results of the average difference test of the effect of urea and nitrate fertilizers on production per barley plant can be seen in Table 1 below.

Table 3. Test Results of Mean Differences in Effect of Urea Fertilizer and Nitrate Fertilizer on Production Per Plant of Barley Plant

Urea Fertilizer		Nitrate Fertilizer	
Treatment	production per plant (g)	Treatment	production per plant (g)
U1	83,55	N1	88,47
U2	100,01	N2	110,05
Average	91,78	Average	99,26

From Table 3, it can be seen that the application of urea fertilizer at a dose of 5 g/plot (U1) had the lowest production per plant of 83.55 g, while the application of urea fertilizer at a dose of 10 g/plot (U2) had a production per plant of 100.01 g. . Production per plant was greater in the application of Nitrate fertilizer with N1 of 88.47 g and N2 of 110.05 g.

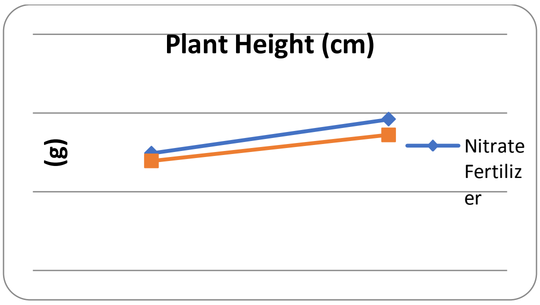

Figure 3. Test Results of Mean Differences in Effect of Urea Fertilizer and Nitrate Fertilizer on Production Per Plant of Barley Plant

V. DISCUSSION

There are several differences between nitrate fertilizer and urea fertilizer, as follows:

- Nitrate is usually found in aerobic soils where nitrification can occur, while ammonia is found in highly acidic soils and in waterlogged anaerobic soils (eg peat soils).
- In terms of evaporation rate, ammonium is more volatile than nitrate. Therefore, the application of nitrate can be done with top dressing, which is sprinkled on the soil surface
- Nitrate fertilizer has the highest nitrogen absorption efficiency, compared to urea fertilization
- Nitrates synergistically promote the uptake of cations, such as K, Ca and Mg, while urea competes for absorption with these cations.
- Nitrates can be easily absorbed by plants without needing to undergo further conversion. The conversion of nitrates to amino acids takes place in the leaves. This process is fueled by solar energy, which makes it an energy efficient process. Medium urea must be converted into organic compounds N in the roots.

- The form of nitrogen taken up has an influence on soil PH, PH increases with NO3 , and decreases with NH4 (becomes more acidic) as a consequence of the difference in the cation-anion absorption ratio.
- Nitrogen in the form of ammonium can be useful in alkaline (basic or ph>7) soils but is problematic in neutral and acidic soils as acid soil toxicity can develop.

Nitrat fertilization enhances the availability of N minerals in the soil (NO3 – and NH4+), which serve as substrates for the nitrification and denitrification processes, resulting in N2O production and emissions. N fertilization was shown to have a beneficial relationship with N2O gas emissions. As a result, by applying N fertilizer correctly, greenhouse gas emissions caused by N fertilization may be decreased (Liu et al. 2012). On land with high yield potential, recommendations for N fertilization based on soil and plant analysis can reduce N2O gas emissions by 7%, and on land with poor yield potential, by 38%.

The right mix of nitrogen fertilization with other nutrients, particularly P nutrients, boosts maize yields while lowering N2O emissions. One technique for ensuring that more fertilizer is absorbed by plants than is lost via denitrification and evaporation is to regulate the availability of N nutrients slowly and continuously during plant growth. Using nitrification inhibitors, fertilizers that release nutrients slowly (controlled release), increasing the amount of fertilizer (urea), or applying fertilizer gradually, plant nutrients can be provided gradually. Basically, plants require nitrification because it allows nutrients to become accessible to them. However, if the nitrification rate is faster than uptake by plants, some of the N nutrients will evaporate. Therefore, the use of nitrification inhibitors or slow-release fertilizers can regulate the release of nutrients to plants. The use of nitrification inhibitors or slow-release fertilizers can reduce N2O emissions (Hu et al. 2013).

When urea is combined with the nitrification inhibitor S. benzylisothiouronium butanoate or S. benzylisothiouronium fluroate, crop yields rise by 4–5%, N2O emissions are reduced by 4–5%, and global warming potential is reduced by 8.9–19.5 percent (Bhatia et al. 2010). Up to 8 weeks after application, increasing the size of urea fertilizer to 1 g/grain can reduce nitrification by 30% compared to regular urea. Gradual fertilizer application, starting with the amount of fertilizer that will be supplied and adjusting to the growth season and degree of plant demands, improves N fertilizer efficiency and lowers fertilizer loss, which has consequences for lowering the possibility for global warming (Tan et al. 2009).

N2O emissions are also influenced by the kind and source of fertilizer. As a result, choosing the right fertilizer suppliers is critical for reducing environmental effect. According to Zanatta et al. (2010), ammonium nitrate > calcium nitrate > uranium (a mixture of urea and ammonium nitrate) > ammonium sulfate > urea > urre + urease inhibitor > slow-release N fertilizer were the sources of relative and total N2O emissions in maize.

VI. CONCLUSION

Based on the analysis above, it can be concluded that the application of Nitrate fertilizer is better than Urea fertilizer. The application of urea and nitrate fertilizers showed a significant effect on the parameters of plant height, number of leaves, and production per plant and production per plot, with the best dose being 10 g/plot. Efficiency of fertilizer use is carried out by applying fertilizer in accordance with recommendations that can be adjusted to the right dose and time of fertilizer application.

REFERENCES

[1]. Agromedia, 2007. Fertilization Instructions. Publisher Agromedia Pustaka, Jakarta

[2]. Bhatia, A., S. Sasmal, N. Jain, H. Pathak, R. Kumar, and A Singh. 2010. Using nitrification inhibitors to reduce nitrous oxide emissions from soil in wheat under conventional and no-tillage conditions. agric. Ecosystem. environment. 136(3–4): 245–253.

[3]. Fajrin, MR. 2016. Composition of Elements in Fertilizer, (online), (www,Chemistric.com/2016/04Composition of Elements in Fertilizer.html, accessed November 24, 2021).

[4]. Hu, X.K., F.Su, X.T. Ju, B. Gao, O. Oenema, P. Christie, B. X. Huang, R.F. Jiang, and F.S. Zhang. 2013. Emissions of greenhouse gases from a wheat–maize double cropping system with various nitrogen fertilizer regimes. Environment. Pollution 176: 198–207.

[5]. Liu, C., K. Wang, and X. Zheng. 2012. N2O and CH4 fluxes in an irrigated wheat maize cropping system in Northern China as a function of fertilizer nitrogen addition rates. Biogeosciences 9: 839–850

[6]. Nainggolan, G.D., Suwardi and Darmawan. 2009. Pattern of Nitrogen Release from Slow Release Fertilizer Urea – Zeolite – Humic Acid. Indonesian Zeolite Journal, Vol. 8, No. 2, 89 – 96

[7]. Salikin, K.A, 2003. Sustainable Agricultural Systems. Kanisius, Yogyakarta.

[8]. Shadow H.T. 2004. Effect of Soil Processing and Placement of Urea Tablets and the Proportion and Time of Urea Fertilizer Application on Growth and Yield of Corn (Zea mays. L). Research Institute for Corn and Other Cereals. Maros

[9]. Sharma, M.K. and P. Kumar. 2011. A Guide to Identifying and Managing Nutrient Deficiencies in Cereal Crops. International Plant Nutrition Institute (IPNI). 50.

[10]. Shahzad, K.A. Khan, and I. Nawaz. 2013. Response of wheat cultivars to various nitrogen levels in Mansehra agroclimatic conditions. science. Tech. and Dev. 32(2): 99- 103

[11]. Snowball, K. and A.D. Robson. 1991. Wheat Nutrient Deficiencies and Toxicities: A Field Identification Guide, Mexico, D.F.: CIMMYT. 82.

[12]. Tan, I.Y.S., H.M. van Es, J.M. Duxbury, J.J. Melkonian, R.R. Schindelbeck, L.D. Geohring, W.D. Hively, and B.N. Moebius. 2009. Single event nitrous oxide losses under maize production as affected by soil type, tillage, rotation, and fertilization. Soil and Tillage Res. 102(1): 19–24.
[13]. Whitney, D.A. 1997. Nutrient Management. In “Wheat Production Handbook”. Kansas State University. 12-15.
[14]. Yousaf, M., S. Fahad, A.N. Shah, M. Shaaban, M.J. Khan, S.A.I. Sabiel, S.A.I. Ali, Y. Wang, and K.A. Osman. 2014. The Effect of Nitrogen Application Rates and Timings of First Irrigation on Wheat Growth and Yield. International J. of Agri. Innovations and Research 2(4): 2319-1473.
[15]. Zanatta, J.A., C. Bayer, F.C.B. Vieira, J. Gomes, and M. Tomazi. 2010. Nitrous oxide and methane fluxes in South Brazilian gleysol as affected by nitrogen fertilizers. Revista Brasileira de Ciência do Solo, Viçosa 34(5): 1653–1665.