CASE STUDY OF THE EFFECT OF CARBOHYDRATE METABOLISM IN COMBINATION OF NPK FERTILIZER AND UREA FERTILIZER ON THE GROWTH OF CORN (ZEA MAYS) PLANTS IN CIREBON REGENCY

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ABSTRACT

The purpose of this study was to determine the best composition of the use of NPK fertilizer and urea fertilizer in the growth and yield of maize in Cirebon Regency. The research was conducted on a rainfed agro-ecosystem owned by farmers in Cirebon Regency, from January to March 2022. The production technology was carried out by Perfect Soil Processing (PSP) with a spacing of 75 cm x 40cm, 2 plants/hole. The study was arranged using a Randomized Block Design (RBD) with 3 replications and 10 combinations of fertilizer doses as treatment. Fertilization was carried out 2 (two) times at the age of 10 days after planting with a dose of 30% Urea and 30% NPK, as well as all SP-36 and KCl, then at 35 DAP with a dose of 70% Urea and 70% NPK. To see the effectiveness of alternative NPK fertilizers, several treatments were combined and some were not with a single fertilizer (Urea). Fertilization is done by tugal about 5 cm next to the plant hole. The conclusion obtained from the results of the field study is that the application of a combination of alternative NPK fertilizers with Urea has better effectiveness than the single application of NPK. However, it had no significant effect on the components of plant height growth.

Keywords: Carbohydrate Metabolism, NPK, Urea Fertilizer

INTRODUCTION

Metabolism is all chemical reactions that occur in organisms including those that occur at the cellular level. Metabolism is also called enzymatic reaction, because metabolism always occurs using an enzyme catalyst (Novitasari, 2017). This study will discuss the metabolism of carbohydrates. Carbohydrates are either polyhydroxyaldehyde or polyhydroxyketone compounds and their derivatives in the form of simple single units complex units. In plants, glucose is synthesized from carbon dioxide (CO2) and air (H2O) through the process of photosynthesis and stored in the form of starch or cellulose (Hanum, 2017). in terms of carbohydrate metabolism to be analyzed is the metabolism in the combination of NPK fertilizer and Urea fertilizer.

Artificial fertilizers are liquid or solid in the form of coarse granules containing the main nutrients nitrogen, phosphorus, and potassium (Gwenzi et al., 2018). NPK fertilizer is one of the most commonly used compound fertilizers. (Parnata, 2004) Urea fertilizer is a chemical fertilizer containing high levels of Nitrogen (N). Nitrogen element is a nutrient that is needed by plants. (Yusmayani, 2019) The irreversible increase in size reflects the increase in protoplasm and dry weight in plants (Wijaya, 2010). The object of research in this study is corn (Zea mays L.) is the world's most important food crop, besides wheat and rice. (Taufiqurrahman, 2017) Cirebon Regency is a district in the province of South Sulawesi, Indonesia.

RESEARCH METHOD

The research method used in this study is a qualitative descriptive method. The type of data used in this study is qualitative data, which is categorized into two types, namely primary data and secondary data (Budianto, 2020). Sources of data obtained through library research techniques (library study) which refers to sources available both online and offline such as: scientific journals, books and news sourced from trusted sources.

These sources are collected based on discussion and linked from one information to another. Data collection techniques used in this study were observation, interviews and research. This data is analyzed and then conclusions are drawn.

RESULT AND DISCUSSION

Study implemented in agro-ecosystem fed rice field rain owned by farmers in the district Cirebon , month January until March 2022. Technology production conducted by Perfect Soil Cultivation (OTS) with distance planting 75 cm x 40 cm, 2 plant / hole . Study arranged with use design Random Group (RAK) 3 replicates and 10 combinations dose fertilizer as treatment .

Fertilization conducted 2 (two) times at the age of 10 Days After Planting (DAT) with dose of 30% Urea and 30% NPK, as well as all SP-36 and KCl , then at 35 DAP with dose of 70% Urea and 70% NPK. For see effectiveness fertilizer alternative NPK , among treatment some are combined and some are not with fertilizer single (Urea). Fertilization conducted with method tugal about 5 cm beside hole plants . After fertilizer inserted , hole buried return with land . Dosage and type fertilizer used _ in study could seen in Table 1.

Table 1. 1 Combination dose fertilizer treatment used _ in research .

Symbol Treatment	Fertilizer dosage (kg ha $^{-1}$)			
	NPK	Urea	SP-36	KCl
A	100	100	0	0
B	100	0	0	0
C	200	100	0	0
D	200	0	0	0
E	300	100	0	0
F	300	0	0	0
G	0	350	100	100
H	350	100	0	0
I	400	0	0	0
J	0	0	0	0

A. Explanation Discussion

Plant Height Statistical test results show that treatment Urea + NPK combination (A, C , E and H), real no different with treatment single NPK (B, D, F and I) against tall plants . Likewise _ when compared to dose recommendation (G) with treatment other , real no different except with treatments A, B and J (Table 2). This describe , good gift single NPK or combination (NPK +Urea) no give influence real to tall plants . Fertilizer NPK alternative no only contains macro nutrients but also the micro - nutrients needed plant

in metabolic processes . Macro nutrients _ needed plant in amount relatively many i.e. 1000 g-1 dry weight plants , while micro nutrients _ by 100 g-1 weight dry plant

Micronutrients that are _ essential push enhancement effectiveness fertilizer NPK alternative . There are three criteria met _ something element said essential namely (1) element the required for complete one cycle life plant normally , (2) element the hold role important in biochemical processes certain in body Plants and their role no could replaced or substituted by whole by element others , and (3) the role from element the in biochemical processes plant needed by straight away . This thing proven from the effect to tall plants on the measure certain . Treatment single fertilizer alternative NPK (D, F and I) and treatment the combination of NPK+ Urea (C, E and H) is real no different with dose recommendation (G). However thereby effectiveness fertilizer NPK alternative tested by single more low than tested _ by combination (Table 2).

This thing caused N content at location study very low . For increase rate growth vegetative plants , need N substitution of Urea fertilizer . Administration of Urea in the phase beginning growth very support growth vegetative plants , because the absorption of nutrients is the fastest occurs in phase vegetative and filling seeds . However administration of excess N Urea could hinder maturity cell , stem weak and easy fall down as well as reduce power stand plant to disease .

Availability nutrients in _ soil very determined by degree acidity soil (pH). Elemental N available in the pH range of 5.5-8.5; element P in the range of 5.5-7.5 and element K in the range of pH 5.5-10.0 (Anonymous , 2010), the pH of the soil at the location study his reaction rather sour ie 6.13. Influence fertilizer alternative NPK and value effectiveness to tall plants . More clear could seen in Table 2.

Table 3. 2 Influence fertilizer alternative NPK and score effectiveness to average tall corn plant in Regency Cirebon

Treatment	Parameter	
	Tall plant (cm)	Score effectiveness fertilizer (%)
A (100 Urea + 100 NPK)	166.17 [b]	45.38
B (100 NPK(11:5:21)	163.27 [b]	38.00
C (100 Urea + 200 NPK)	182.57 [a]	87.14
D (200 NPK)	172.40 [ab]	61.24
E (100 Urea +300 NPK)	185.72 [a]	95.16
F (300 NPK)	183.82 [a]	90.32
G (350 kg Urea+100 kg SP-36+100 kg KCl)	187.62 [a]	Control
H (100 Urea +350 NPK)	186.45 [a]	97.02
I (400 NPK)	181.50 [a]	84.42
J (Without fertilizer)	148.35 [c]	Control
KK (%)	5.43	

Information: Number in lane which followed letter which same no different real according to Multiple test Duncan 0.05%.

Table 3. 3 The effect of alternative NPK fertilizer and its effectiveness value on the average height of cobs .

Treatment	Tall cob (cm)	Score effectiveness fertilizer (%)
A (100 Urea + 100 NPK)	70.85 [bc]	62.73
B (100 NPK)	63.17 [c]	42.32
C (100 Urea + 200 NPK)	78.00 [ab]	81.74
D (200 NPK)	70.87 [bc]	62.78
E (100 Urea +300 NPK)	79.50 [ab]	85.72
F (300 NPK)	77.62 [ab]	80.73
G (350 kg Urea+100 kg SP-36+100 kg KCl)	84.87 [a]	Standard
H (100 Urea +350 NPK)	81.17 [ab]	90.16
I (400 NPK)	76.37 [ab]	77,40
J (Without fertilizer)	47.25 [d]	Control
KK (%)	8.94	

Information: Number in lane which followed letter which same no different real according totest multiple Duncan 0.05%.

Effectiveness value fertilizer good NPK alternative applied by single (NPK) or combined (Urea + NPK), fixed give influence good to growth tall plant corn , except with J treatment as control fertility land . Treatment J (without fertilizer), give influence tall plant shortest and different to all treatment . This describe that fertility soil by natural , no capable Fulfill plant nutrient requirements without nutrient substitution of fertilizer . Giving fertilizer on plants corn spur growth vegetative and generative plants , so plant Becomes more productive (Bahri et al., 2019). The more tall plants , more big rate growth plants and more many produce photosynthate as well as biomass for supply feed cattle

1. Cob Height

Influence fertilizer NPK alternative to tall cob , fine treatment combinations (C, E, and H) and treatment single (F and I) gives same influence _ with treatment G measure recommendations (Table 3).

Observation results obtained _ describe that gift single fertilizer alternative NPK at a dose of 300 and 400 kg ha-1 can give same influence _ with treatment combination (NPK + Urea) against tall cob . Fertilizer alternative to NPK, other than contain macro nutrients needed _ _ plant in amount abundant , also contains micro nutrients (Mn, Ca, Cu, Fe, Bo, Na, Mg, Hg, Cd, B, and Co) needed plant in amount a little however essential whose function no could replaced element another . Element Iron (Fe) has function that is not could replaced other elements in the formation green leaves . Fe is also one of the elements needed for the formation of enzymes - enzymes oxidizing breathing _ hydrate charcoal to acid gas charcoal and water. Fe in plant not enough move , so when plant deficiency substance iron , will look symptoms in the plants that are still young (Colombo et al., 2014). Likewise the elements micro other contained _ in fertilizer NPK alternative , has role that is not can replaced by element another . With so , fine gift single (NPK) or

combination (NPK+Urea) at the dose certain , able spur growth tall cob so that real no different real with treatment dose recommendation to tall cob . Element micro very needed in activity photosynthesis plants , which produce ingredient dry for spur growth plants (Salama et al., 2017). Position height cob important owned something varieties because related with attack pest certain .

Weakness fertilizer compound content wish low compared to fertilizer single . Every 100 kg of fertilizer alternative NPK there are 24 kg of Urea, while recommendation for optimal growth of corn composite it takes 300-350 kg of Urea ha-1 . With thereby fertilizer alternative NPK need additional urea for increase power its effectiveness .

2. Weight biomass

Use single fertilizer alternative NPK and combination (NPK+Urea) (H, E and I) real no take effect to weight biomass compared to treatment G measure recommendations (Table 4). This describe that use by combination (E and H) and use single (I) equal the effect with fertilizer standard dose recommendation (G) against weight biomass . Fertilizer NPK alternative combined with more Urea good than given _ by single without Urea, however the effect same to weight biomass . Biomass as feed very related with development cattle ruminants . Data show that population cow cut in Indonesia less related with existence grass as a grazing area natural , however very related with planting plant food like rice , corn and secondary crops (Subandi , 2005). Weight biomass every treatment (Table 4).

Availability feed cattle in the form of straw corn very support management cattle by intensive through system containment . On research this range biomass corn obtained 4,15-10,15 t ha-1, the lowest weight the biomass is treatment (J) as control fertility land (4.15 t ha-1) and the highest is treatment (G) dose recommendation (10.15 t ha-1). By whole treatment combination fertilizer alternative NPK with Urea provides weight biomass more tall compared to treatment single fertilizer alternative to NPK without Urea (Table 4). This thing caused N content in soil location study low so that additional N in the phase beginning growth plant very required . Available nitrogen for plant will influence protein formation , part vegetative as well as formation various ingredient organic others (Rinsema, 1986 in Anonymous , 2010).

3. Component Yield Weight 1000 seeds .

Plant nutrient adequacy will spur increase 1000 seeds weight corn . Dose recommendation fertilizer single for corn composite still character general namely 350 kg Urea + 100 kg SP- 36 + 100 kg KCL ha-1. Needs fertilizer inorganic planting corn per hectare are Urea 200-300 kg, SP-36 75-100 kg, and KCl ± 50 kg. Use fertilizer must customized with type , dosage and time proper gift . _ Treatment fertilization NPK alternative , good gift by combination (NPK+Urea) or gift by single (real NPK no take effect to weight 1000 seeds , except with treatment J (control fertility ground) is different real with all treatment (Table 5). This describe that by natural fertility soil no capable supply plant nutrient requirements corn . In general , in the area tropical wet nutrient content of N in soil no enough for support growth and yield plant optimal maize (Wahid et al., 2006). Treatment (G) dose recommendation give 1000 seeds weight highest , however real no different with treatments E, F, H and I (Table 5). Element phosphorus hold role important in addition weight seeds . phosphorus increase results ingredient dry , weight seeds , fix quality results and speed up maturity .

Insufficiency supply P makes plant no grow maximum , potential result no maximum and not capable complement the normal reproductive process (Nyakpa et al., 1988 in Anonymous , 2010). Though treatment (G) dose recommendation get additional 100 kg SP-36 however no different with treatment other (E,F,H and I) to 1000 seeds weight . This thing caused soil at location study content The phosphorus high (96%). Elemental Potassium is not play a role as composer plants , but working in arrange various mechanism metabolic like photosynthesis , translocation carbohydrate and protein synthesis (Saifuddin, 1985).

To production flakes dry , treatment combination fertilizer alternative NPK with Urea (E and H) and treatment single fertilizer alternative NPK (F and I) real no different with treatment G (Table 6). However thereby the relative value of agronomic effectiveness (RAE) of administration by combination more good from giving _ by single (Table 6). This describe that fertilizer alternative NPK effectiveness more good if combined with Urea fertilizer against production flakes dry corn (Table 6).

Treatment of G as dose recommendation supply 161 kg N, 36 kg P2O5 and 60 kg K2O plants with production corn flakes dry 8.12 t ha-1. While treatment H supplies plant 84.5 kg N; 17.5 kg P2O5 and 73.5 kg K2O with production corn flakes dry 7.95 t ha-1 . N levels in treatment recommendation more tall compared to treatment other .

Lots of nitrogen nutrients required plant in phase beginning growth for stimulate growth vegetative plant specifically stems and leaves (Leghari et al., 2016). Nitrogen deficiency in plants result in growth slow , plant stunted , growth root hampered and color leaf yellow and dry (Lingga , 1994 in Anonymous , 2011). Besides nitrogen content , fertilizer alternative NPK too contain phosphorus . Nutrient phosphorus _ heighten result , add weight seeds , fix quality results and speed up .

Table 1. 4 Influence fertilizer alternative NPK and score effectiveness to average biomass weight

Treatment	Weight biomass (t ha $^{-1}$)	Score effectiveness fertilizer (%)
A (100 Urea + 100 NPK	8.47 ^{d}	72.00
B (100 NPK)	8.40 ^{d}	70.83
C (100 Urea + 200 NPK	9.07 ^{bcd}	82.00
D (200 NPK)	8.82 ^{cd}	77.83
E (100 Urea +300 NPK)	9.60 ^{abc}	90.83
F (300 NPK)	9.10 ^{bcd}	82.50
G (350 kg Urea+100 kg SP-36+100 kg KCl)	10.15 ^{a}	Standard
H (100 Urea +350 NPK)	9.87 ^{ab}	95.33
I (400 NPK)	9.30 abcd	85.83
J (Without fertilizer)	4.15 ^{e}	Control
KK (%)	6.58	

Information : Numbers in lane which followed letter which same no real different according totest multiple Duncan 0.05%.

Table 1. 5 Influence fertilizer alternative NPK and score effectiveness to weight 1000 seeds (g)

Treatment	Weight 1000 seed (g)	Score effectiveness fertilizer (%)
A (100 Urea + 100 NPK)	309.05 [b]	61.68
B (100 NPK)	304.15 [b]	59.55
C (100 Urea + 200 NPK)	320.43 [b]	66.61
D (200 NPK)	314.35 [b]	63.98
E (100 Urea +300 NPK)	344.55 [ab]	77.08
F (300 NPK)	338.73 [ab]	74.55
G (350 kg Urea+100 kg SP-36+100 kg KCl)	397.40 [a]	Standard
H (100 Urea +350 NPK)	340.15 [a]	75.17
I (400 NPK)	329.38 [a]	70,50
J (Without fertilizer)	166.85 [c]	Control
KK (%)	12.39	

Information : Numbers in lane which followed letter which same no real different according totest multiple Duncan 0.05%.

phosphorus play a role important as ingredient burn for all activity biochemistry in cell live . Adenosine triphosphate (ATP) releases energy required _ for activity plants . Element phosphorus increase weight next seed _ could increase endurance save seeds (Muqnisah and Nakamura, 1984. in Syafruddin , 2003). Besides N and P content, Potassium content in H treatment is more than high (73.5 kg K2O) compared to treatment G (60 kg). Nutrient K is needed plant corn in more quantity _ many compared to N and P nutrients, and reached 60-75% accumulation of K nutrients in the phase flowering (Tandisau et al., 2006).

For produce corn white with an average yield of 5 t ha-1, plants corn absorb K nutrients as much as 18,530 kg ton-1 seeds corn , nutrient N 14,140 kg ton-1 seed corn and nutrient P as much as 1,405 kg ton-1 seed corn . Without plant potassium nutrients corn no capable reach maximum growth and yield . _ Elemental potassium plays a role as catalyst in converts protein into amino acids as well as in synthesis and disassembly carbohydrates . Elemental potassium is hygroscopic cause pressure osmotic increase and stomata open so the CO2 gas enters and it happens photosynthesis .

Accumulation photosynthate in the form of ingredient dry spur production corn flakes dry . Advantages fertilizer alternative NPK other than contain element macro (N, P, K, Mg and Ca) also contain a number of element many micronutrients (Na, Mn, Cu, Zn, Pb, Cd, Co, B, Mo, Ad, Hg) needed in the metabolic process carbohydrates , synthesis chlorophyll , respiration and composition enzymes .

Activities element micro especially Manganese (Mn) plays a role in synthesis chlorophyll and as coenzyme . Manganese plays a role as well as as activator a number of enzyme respiration , in reaction nitrogen metabolism and photosynthesis (Weisany et al., 2013). Manganese is also needed for activate nitrate reductase so that plants that experience Manganese deficiency requires source N in NH4+ . form

Every contained elements _ in fertilizer alternative NPK holding role for stimulate growth metabolism . one _ element micro contained _ is zinc. Zinc in rate low give encouragement to growth . Whereas when rate too much will Becomes poison for plants . Zinc compounds have function on formation hormone grow (auxin) and important for balance psychological (Campos et al., 2014) . Symptom Zinc deficiency is leaf Among bones leaf colored red chocolate .

Table 1. 6 Influence fertilizer alternative NPK and score effectiveness to production corn flakes dry (t ha $^{-1}$).

Treatment	Production corn flakes dry (th $^{-1}$)	Score effectiveness fertilizer (%)
A (100 Urea + 100 NPK)	6.60 ^{d}	77.55
B (100 NPK)	5.45 ^{e}	60.56
C (100 Urea + 200 NPK)	7.15 ^{bcd}	85.67
D (200 NPK)	6.92 ^{cd}	82.27
E (100 Urea +300 NPK)	7.72 ^{abc}	94.09
F (300 NPK)	7.32 abcd	88.13
G (300 Urea+100 SP-36+100 KCl)	8.12 ^{a}	Recommendation
H (100 Urea +350 NPK)	7.95 ^{ab}	97.49
I (400 NPK)	7.32 abcd	88.18
J (Without fertilizer)	1.35 ^{f}	Control
KK(%)	8.78	

Information: Numbers in lane which followed letter which same no different real according totest multiple Duncan 0.05%.

B. Opinion Reviewer Against That Data

For produce plant fertile corn _ quality , as well eat costs that are not big then the groups farmer could give combination NPK fertilizer and urea in plants corn , thing this could give influence to enhancement activity photosynthesis used by plants _ as source energy for plants .

Plant corn is commodity food second after rice , on the other side of the crop this use lots of nutrients from soil compared plant other (Chauhan et al., 2012). With thereby availability means the right fertilizer time , right type and right dose Becomes important in reach success farming corn . For support enhancement productivity and success - continued development sector agriculture plant food and horticulture , government provide subsidies _ Urea , SP-36, KCl and ZA fertilizers. However because lately this condition the economy in Indonesia is lacking improve , so government apply policy deletion subsidy fertilizer by

gradually . Consequence directly experienced _ farmer with policy is soared - nya price fertilizer ,

For increase effectiveness fertilizer NPK alternative in spur growth and production corn , then conducted combination with Urea fertilizer . To use increase efficiency and effectiveness use fertilizer , then must noticed type plants and nutrient requirements for reach optimal results , rate availability of nutrients in ground , shape fertilizer and time as well as method proper gift . _ Practice fertilization show that no all fertilizer given _ absorbed by plants . To earn _ every ton of seeds corn 27.4 kg N is required ; 4.8 kg P and 18.4 kg K

C. Explanation Condition factual

How metabolism carbohydrates that occur Among concentration NPK fertilizer and urea fertilizer in growth and yield plant corn in the district Cirebon .

D. Offered Solutions

Solutions offered from results study study this , namely :

1. The need study advanced related amount dose gift combination NPK and urea fertilizers, with destination for knowing potency dose best influence _ metabolism plant to growth and yield harvest plant corn .

2. Problem related market needs quality and quantity results plant corn sweet could conducted with gift combined fertilizer _ with fertilizer organic other , which aims for achievement sustainable and friendly agriculture _ environment .

E. Support Theory / Research Results

A number of results study related importance analyze metabolism in plants is as following :

1. Productivity and quality product determined by usage ingredient plants , techniques cultivation , as well as activity pre and post harvest (Darmawidah and Amiroeddin , 2002). Use ingredient fertilizer that does not in accordance needs plant is beginning determinant low production and quality product corn , mature this part big plant cultivated corn _ still use one fertilizer chemistry .

2. The size production corn very depends from maintenance plants , especially gift proper fertilizer (Sunanto , 2010).

CONCLUSION

The conclusion obtained from the results of the field study is that the application of an alternative combination of NPK fertilizer with the effectiveness value of Urea is better than the application of a single NPK. However, there is no significant effect on the growth of tall plant components. The application of a good alternative NPK fertilizer combined with Urea and the application of a single NPK without Urea (E, F, H and I) gave no significant effect on the weight of 1000 seeds and dry corn flakes production. The highest dry corn flakes production was achieved by treatment G recommendation size (8.12 tha-1) but it was not

significantly different from treatments E, F, H and I with each production of 7.72; 7.32; 7.95 and 7.32 tha-1

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