International Journal of Environment, Agriculture and Biotechnology
Vol-9, Issue-4; Jul-Aug, 2024
Peer-Reviewed International Journal
Journal Home Page Available: https://ijeab.com/
Journal DOI: 10.22161/ijeab

Effect of Nitrogen Fertilization Dosage on Growth and Yield of Three Varieties of Glutinous Corn *(Zea mays var. ceratina)*

Ardian Tri Wahyu Ridha'i[1], Sudiarso[2] and Karuniawan Puji Wicaksono[2]

[1]Master Student at Department of Agronomy, Faculty of Agriculture, Brawijaya University, Malang, Indonesia
[2]Department of Agronomy, Faculty of Agriculture, Brawijaya University, Malang, Indonesia
*Corresponding author Email : Ardiantri82@gmail.com

Received: 03 Jun 2024; Received in revised form: 01 Jul 2024; Accepted: 10 Jul 2024; Available online: 19 Jul 2024

Abstract— *Superior varieties are one of the technological components that are very important in achieving high production. The use of nitrogen fertilizer is the most important factor for plant growth and development. Chemical fertilizers in general and nitrogen fertilizers in particular are important determinants of productivity levels per unit area, and the importance of increasing the use of chemical fertilizers in soil conditions that lack organic matter. The research was carried out from February 2023 to May 2023 at Agro Techno Park, Jatikerto Village, Kromengan District, Malang Regency. The research was carried out in the form of a factorial experiment arranged in a Randomized Group Design (RGD). Consists of 2 factors, where the first factor is three varieties of glutinous corn and the second factor is the dose of nitrogen fertilizer. The first factor, varieties which consist of 3 levels, namely: Arumba Variety (V1), Srikandi Variety (V2), and URI 1 Variety (V3). The second factor, nitrogen fertilization dosage with 4 levels, namely: No fertilizer/Control (A0), Nitrogen 100 kg ha^{1-} (A1), Nitrogen 200 kg ha^{1-} (A2), and Nitrogen 300 kg ha^{1-} (A3). Overall, the variety treatment and N fertilizer dose showed a significant interaction effect on all growth parameters except for the number of leaves at 42 DAP, and leaf area at 14, 21, 35 and 49 DAP. The variety treatment and N fertilizer dose showed a significant interaction effect on all yield parameters except ear length. Variety treatment and N fertilizer dosage had an influence on the analysis of increasing starch, amylose and amylopectin content. The Srikandi variety had the highest yield in every growth and yield of glutinous corn followed by the Arumba and URI 1 varieties. In the treatment with a N fertilizer dose of 300 kg ha^{1-} had the highest yield in every observed parameter.*

Keywords— ***Maize, Nitrogen fertilizer, Varieties, Growth components, Yield components***

I. INTRODUCTION

Glutinous corn (*Zea mays var. ceratina*) is a type of corn that has a high amylopectin content, which causes the texture of the corn to become soft and fluffier. Glutinous corn is widely used for consumption, both in fresh form and in processed products because it has a sweet, soft taste and attractive appearance that other corn does not have (Tengah *et al*., 2017). Until now, Indonesia still relies on imports to meet demand for corn from the industrial sector. Corn imports throughout 2018 reached 737.22 thousand tons with a value of US$ 150.54 million.Increasing glutinous corn production needs to be done in line with increasing demand for glutinous corn.Variety is one of the many factors that determine plant growth and yield. Using the right varieties will increase glutinous corn production. Superior varieties are one of the technological components that are very important in achieving high production. Nitrogen fertilizer is the most important fertilizer for plant growth and development. Nitrogen fertilizer deficiency is a major factor limiting crop growth, yield and quality. Chemical fertilizers in general and nitrogen fertilizers in particular are important

determinants of productivity levels per unit area, and the importance of increasing the use of chemical fertilizers in soil conditions that lack organic matter (Alamer and Alsharifi, 2020). Nitrogen is the main nutrient that is most important for increasing production, because corn plants respond very well to nitrogen fertilizer and about half of the nitrogen absorbed by grain is well accumulated (Alsharifi *et al.*, 2021). Jatikerto Village is included in the southern Malang region, it is a lowland with a height of 303 m. asl. and an average temperature of 23°C to 28°C. Jatikerto Village is a village with a agroecosystem type namely dry land planted with seasonal or annual crops, such as rice, secondary crops and horticulture. The moor is very dependent on rainwater. Therefore, appropriate management efforts are needed so that plant growth and production can be maximized. These efforts include providing balanced fertilizer and using corn varieties that suit land conditions.

II. MATERIALS AND METHODS

The research was carried out from February 2023 to May 2023 at Agro Techno Park, Jatikerto Village, Kromengan District, Malang Regency. Jatikerto Village is included in the southern Malang region, it is a lowland with a height of ± 300 m. asl. In carrying out this research, the tools used included a hoe, a stick, a sickle, a sprayer tank, measuring cups, buckets, scales, meters, rulers, label boards, cameras, and writing tools to record the results. The materials used in this research included glutinous corn seeds of the Arumba F1, Srikandi F1, and URI 1 varieties. Other materials used included Urea Nitrogen Fertilizer, NPK Phonska 15:15:15 Compound Fertilizer, pesticides and herbicides. The research used a design in the form of a factorial experiment arranged in a Randomized Group Design (RGD). Consists of 2 factors, where the first factor is three varieties of glutinous corn and the second factor is the dose of nitrogen fertilizer. The first factor, varieties which consist of 3 levels, namely: Arumba Variety (V1), Srikandi Variety (V2), and URI 1 Variety (V3). The second factor, nitrogen fertilization dosage with 4 levels, namely: No fertilizer/Control (A0), Nitrogen 100 kg ha^{1-} (A1), Nitrogen 200 kg ha^{1-} (A2), and Nitrogen 300 kg ha^{1-} (A3). Thus, for the entire experiment, 12 treatments were obtained with 3 replications so that there were 36 experimental plot units. Where each experimental plot consists of 40 plants and each experimental unit consists of 15 sample plants that are observed. The data from the observations were then analyzed using analysis of variance (F test) with a level of 5% with the aim of finding out whether the effect of the treatment was real or not. If there is a significant difference, then continue the BNJ test with a level of 5%. Parameters observed include plant height, number of leaves and leaf area, dry weight, plant growth rate (CGR), net assimilation rate (NAR), leaf area ratio (LAR), cob length, cob diameter, fresh weight of cob without husk , fresh weight of cob with husks, yield per hectare and starch, amylose and amylopectin content tests.

III. RESULT

Plant Height

Table 1. Average Height of Glutinous Corn Due to the Interaction Effect of Variety Treatment and N Fertilizer Dosage at observation ages 14, 21, and 28 DAP.

Day after planting (DAP)	Nitrogen dose (kg ha^{-1})	Varieties		
		Arumba	Srikandi	URI 1
14	0	19,83 b A	16,95 a A	16,61 a A
	100	21,44 b A	18,56 a A	17,83 a A
	200	21,72 b A	21,06 b B	18,33 a A
	300	22,06 b A	22,61 b B	18,61 a A
	HSD Varieties (5%)		2,43	
	HSD Nitrogen (5%)		2,20	
21	0	30 b A	29,17 b A	22 a A
	100	31,39 b B	30,42 b AB	24 a B
	200	31,92 b B	31,28 b B	25,25 a B
	300	32,39 b B	32,78 b C	26,83 a C
	HSD Varieties (5%)		1,28	
	HSD Nitrogen (5%)		1,16	
28	0	59,61 c A	54,06 b A	37,06 a A
	100	63,62 c AB	57,28 b AB	46,11 a AB
	200	65,44 b B	62,06 b BC	47,22 a B
	300	66,17 b B	63,59 b C	52,72 a C
	HSD Varieties (5%)		5,09	
	HSD Nitrogen (5%)		4,61	

The results of the analysis of variance showed that there was a real interaction between the application of nitrogen fertilizer to three different varieties at all ages of observing the growth of glutinous corn plants and this increased with increasing nitrogen doses. The dose of 300 kg ha^{1-} was significantly different from the control in all varieties. At each observation age, the Srikandi variety with a dose of 300 kg ha^{1-} had the highest value, followed by the Arumba and URI 1 varieties.

Table 2. Average Height of Glutinous Corn Treatment Varieties and N Fertilizer Doses at observation ages 35, 42, and 49 DAP.

Day after planting (DAP)	Nitrogen dose (kg ha⁻¹)	Varieties		
		Arumba	Srikandi	URI 1
35	0	86,22 c A	76,22 b A	37,44 a A
	100	90,05 b AB	92,39 b B	54,44 a B
	200	97 b BC	94,97 b B	57,44 a B
	300	99 b C	97,42 b B	69,97 a C
	HSD Varieties (5%)		7,57	
	HSD Nitrogen (5%)		6,85	
42	0	109,7 b A	92,7 ab A	83,3 a A
	100	127,2 b AB	138,9 b B	86,7 a AB
	200	131,9 b AB	140,5 b B	99,5 a AB
	300	141,4 b B	151 b B	107,5 a B
	HSD Varieties (5%)		23,57	
	HSD Nitrogen (5%)		21,32	
49	0	134,7 b A	127,2 b A	81,7 a A
	100	139,8 b AB	164,4 c B	103,3 a B
	200	152,6 b BC	166,7 b B	107,4 a B
	300	165 b C	173,9 b B	108,7 a B
	HSD Varieties (5%)		16,28	
	HSD Nitrogen (5%)		14,73	

Number of leaves

Table 3. Average Number of Glutinous Corn Leaves Effect of Interaction Between Variety Treatment and N Fertilizer Dosage at observation ages 14, 21, and 28 DAP.

Day after planting (DAP)	Nitrogen dose (kg ha⁻¹)	Varieties		
		Arumba	Srikandi	URI 1
14	0	19,83 b A	16,95 a A	16,61 a A
	100	21,44 b A	18,56 a A	17,83 a A
	200	21,72 b A	21,06 b B	18,33 a A
	300	22,06 b A	22,61 b B	18,61 a A
	HSD Varieties (5%)		2,43	
	HSD Nitrogen (5%)		2,20	
21	0	30 b A	29,17 b A	22 a A
	100	31,39 b B	30,42 b AB	24 a B
	200	31,92 b B	31,28 b B	25,25 a B
	300	32,39 b B	32,78 b C	26,83 a C
	HSD Varieties (5%)		1,28	
	HSD Nitrogen (5%)		1,16	
28	0	59,61 c A	54,06 b A	37,06 a A
	100	63,62 c AB	57,28 b AB	46,11 a AB
	200	65,44 b B	62,06 b BC	47,22 a B
	300	66,17 b B	63,59 b C	52,72 a C
	HSD Varieties (5%)		5,09	
	HSD Nitrogen (5%)		4,61	

The results of the analysis of variance showed a real interaction between the application of nitrogen fertilizer to three different varieties at the observation ages of 14, 21, 28, 35 and 42 DAP. At the observation age of 14 DAP, it showed an increase in the number of leaves of glutinous corn plants as the dose of nitrogen fertilizer increased. At the age of 49 DAP the arumba variety had the highest value.

Table 4. Average Number of Leaves for Varieties and N Fertilizer Doses at Observation Age 35 and 42 DAP.

Day after planting (DAP)	Nitrogen dose (kg ha⁻¹)	Varieties		
		Arumba	Srikandi	URI 1
35	0	9,94 b A	10,83 b A	6,94 a A
	100	11,78 b B	11,67 b A	8 a AB
	200	13,61 b C	13,17 b B	9,06 a BC
	300	14,39 b C	14,17 b B	9,22 a C
	HSD Varieties (5%)		1,18	
	HSD Nitrogen (5%)		1,07	
42	0	9,11 b A	11,28 c A	6,39 a A
	100	11,06 b B	12,06 b AB	8,11 a AB
	200	13,94 b C	13,22 b BC	8,72 a B
	300	14,61 b C	14,28 b C	11,11 a C
	HSD Varieties (5%)		1,81	
	HSD Nitrogen (5%)		1,64	

Treatment	Number of leaves (leaves)
	49 DAP
Nitrogen dose (kg ha⁻¹)	
0	6,78
100	7,70
200	9,11
300	9,94
HSD 5%	tn
Varieties	
Arumba	9,06
Srikandi	9,53
URI 1	6,57
HSD 5%	tn

At the observation age of 49 DAP, it showed an increase in the number of plant leaves as the dose of nitrogen fertilizer increased. At a dose of 300 kg ha¹⁻ has the highest value of 9.94 strands tan⁻¹. The Srikandi variety has the highest value of 9.53 strands tan⁻¹.

Leaf area

Table 5. Average Leaf Area Due to the Effect of Interaction Between Variety Treatment and N Fertilizer Dosage.

Day after planting (DAP)	Nitrogen dose (kg ha¬¹)	Varieties		
		Arumba	Srikandi	URI 1
28	0	251 b A	214,3 b A	113,8 a A
	100	259,5 b A	225,4 b A	119,3 a A
	200	273,6 b A	244,2 b AB	145 a A
	300	287,6 a A	289,7 a B	251,5 a B
	HSD Varieties (5%)		57,70	
	HSD Nitrogen (5%)		52,20	
42	0	376,4 b A	415,4 b A	177,6 a A
	100	449,7 b AB	421,1 b A	286,7 a AB
	200	481 a AB	474,6 a A	391,2 a B
	300	576 b B	740,5 c B	404,4 a B
	HSD Varieties (5%)		145,65	
	HSD Nitrogen (5%)		131,77	

The results of the analysis of variance showed that there was a real interaction at the observation ages of 28 and 42 DAP. At the observation ages of 28 and 42 DAP, it showed an increase in plant leaf area as the dose of nitrogen fertilizer increased for each variety. At the observation age of 21 DAP, it increased with the addition of nitrogen fertilizer doses but was not significantly different. The Srikandi and Arumba varieties are significantly different from the URI 1 variety at 105.3 cm^2 $tang^{1-}$ and 111.5 cm^2 $tang^{1-}$.

Treatment	Leaf area (cm^2 $plant^{-1}$) Day after planting (DAP)			
	14	21	35	49
Nitrogen dose (kg ha^{-1})				
0 kg N ha^{-1} ,	38,63 a	87,53	294,6 a	344,2 a
100 kg N ha^{-1}	53,59 ab	95,87	355,2 ab	438,3 ab
200 kg N ha^{-1}	53,13 ab	98,00	375,7 b	468,7 ab
300 kg N ha^{-1}	65,33 b	112,2	416,9 b	537,6 b
HSD 5%	17,92	ns	63,52	142,38
Varieties				
Arumba	56,68	111,5 b	427,7 b	477,8
Srikandi	58,48	105,3 b	406,9 b	473,1
URI 1	42,84	78,31 a	247,1 a	390,7
HSD 5%	ns	18,72	49,77	ns

Crop Growth Rate (CGR)

Observations show that the results are not significantly different for each observation parameter. Of the three varieties observed, the Arumba variety was the variety that had a growth pattern with a high value, followed by the Srikandi and URI 1 varieties. The Arumba and Srikandi varieties had the same growth pattern value at the age of 35-42 DAP. The URI 1 variety shows a growth pattern that tends to be constant and has a low value. It is known that varieties influence plant growth patterns and growth patterns increase during the initial phase of the plant and begin to decrease during the generative phase of glutinous corn plants aged 35-42 DAP.

Net Assimilation Rate (NAR)

The net assimilation rate shows that the treatment dose of N fertilizer is not significantly different to the net assimilation rate. At N fertilizer doses of 300 kg ha^{1-} and 200 kg ha^{1-} the net assimilation rate increased rapidly and was highest compared to N fertilizer doses of 0 kg ha100, $^{1-}$ kg ha^{1-}, at the age of 21-28 DAP to 28-35 DAP and decreases at the age of 35-42 DAP. The net assimilation rate of glutinous corn in the treatment varieties was also not significantly different.

Leaf Area Ratio (LAR)

The leaf area ratio shows that the treatment dose of N fertilizer is not significantly different from the leaf area ratio at various ages of observation. At N fertilizer doses aged 21-28 DAP, 28-35 DAP, and 35-42 DAP there was a decrease in the leaf area ratio. The variety treatments showed no significant difference in observing the leaf area ratio and there was a decrease in values from the beginning of the observation to the end of the observation. The Arumba variety had the highest leaf area ratio per age of observation, followed by the Srikandi and URI 1 varieties. So it is known that the leaf area ratio has no significant effect on the variety treatment and N fertilizer dose.

Dry weight

The results of analysis of variance showed that dry weight had no significant effect on variety treatment and N fertilizer dose. It was known from each age of observation that increasing the N fertilizer dose resulted in an increase in plant dry weight. It is also known that the variety treatment shows that the Srikandi variety has a high dry weight value at each observation age, followed by the Arumba and URI 1 varieties.

Cob length

The results of the analysis of variance show that cob length has a significant effect on the treatment of the N fertilizer dose. It is known that each additional dose of N fertilizer increases the length of the plant cob. At a dose of 300 kg ha^{1-} has the highest value, namely 18.81 cm. The variety treatments showed that there was no significant difference between each variety. The Srikandi variety has the highest cob length, followed by the Arumba and URI 1 varieties.

Table 6. Average Length of Glutinous corn Cobs in the Variety and N Fertilizer Dosage Treatments.

Treatment	Components of Glutinous Corn Results
	Cob length (cm)
Nitrogen dose (kg ha¯¹)	
0 kg N ha-¹ ,	15,99 a
100 kg N ha-¹	17,62 ab
200 kg N ha-¹	18,13 b
300 kg N ha-¹	18,81 b
HSD 5%	1,96
Varieties	
Arumba	17,00
Srikandi	18,27
URI 1	17,65
HSD 5%	ns

Cob diameter

Table 7. Average Diameter of Glutinous corn Cobs Due to the Effect of Interaction Between Variety Treatment and N Fertilizer Dosage.

Observation parameters	Nitrogen dose (kg ha¯¹)	Varieties		
		Arumba	Srikandi	URI 1
Cob diameter (cm)	0	4,09 b	3,83 b	2,61 a
		A	A	A
	100	4,22 a	4,7 b	4,14 a
		AB	B	B
	200	4,22 a	4,75 b	4,15 a
		AB	B	B
	300	4,52 a	4,78 a	4,46 a
		B	B	B
	HSD Varieties (5%)		0,41	
	HSD Nitrogen (5%)		0,37	

The results of analysis of variance show that cob diameter shows a significant interaction with variety treatment and N fertilizer dose. It is known that at a dose of 100 kg ha200 ¹- kg ha¹- the Srikandi variety has a significant effect on the arumba and URI 1 varieties. At a dose of 300 kg ha ¹- The Srikandi variety has the highest value, followed by the Arumba and URI 1 varieties.

Fresh weight of cob with husks

Table 8. Average fresh weight of cobs with glutinous corn husks due to the interaction effect between variety treatment and N fertilizer dose.

Observation parameters	Nitrogen dose (kg ha¯¹)	Varieties		
		Arumba	Srikandi	URI 1
Fresh weight of cob with husk (g plant-¹)	0	157,4 b	119,6 b	80,2 a
		A	A	A
	100	171,9 a	222 b	182,3 a
		AB	B	B
	200	183,3 a	228,1 b	185,2 a
		AB	B	B
	300	204,4 a	234,8 a	216,7 a
		B	B	B
	HSD Varieties (5%)		43,18	
	HSD Nitrogen (5%)		39,06	

The results of the analysis of variance showed a significant interaction with variety treatment and N fertilizer dose. It was found that as the N fertilizer dose increased, the weight of all varieties increased. Each dose of N fertilizer was significantly different between varieties, but at a dose of 300 kg ha¹- it was not significantly different between varieties. The control and URI 1 sugar apple varieties were significantly different with each dose of N fertilizer. The highest value for fresh weight of cobs with husks was for the 300 kg ha¹- dose of the sugar apple variety, namely 234.8 g tan-¹ followed by the URI 1 variety 216.7 g tan-¹ and arumba variety 204.4 g ton-¹.

Fresh weight of cob without husk

Table 9. Average fresh weight of cobs without glutinous corn husks due to the interaction effect between variety treatment and N fertilizer dose.

Observation parameters	Nitrogen dose (kg ha¯¹)	Varieties		
		Arumba	Srikandi	URI 1
Fresh weight of cob without husk (g plant-¹)	0	124,8 c	79,6 b	40,2 a
		A	A	A
	100	131,9 a	188,1 b	149,6 a
		A	B	B
	200	143,3 a	190,9 b	151,2 a
		A	B	B
	300	164,4 a	194,8 a	176,7 a
		A	B	B
	HSD Varieties (5%)		41,22	
	HSD Nitrogen (5%)		37,29	

The results of the analysis of variance in fresh weight of cobs without husks showed a significant interaction with variety treatment and N fertilizer dose in Appendix 18. It was found that as the N fertilizer dose increased, the weight of all varieties increased. Each dose of N fertilizer was significantly different between varieties, but at a dose of 300 kg ha¹- it was not significantly different between varieties. The control and URI 1 varieties of sugar apples were significantly different with each dose of N fertilizer. The highest value of fresh weight of cobs without husks for the sugar apple variety at a dose of 300 kg ha¹- was 194.8 g tons, followed by the URI 1 variety 176.7 g tons. ¹ and arumba variety 164.4 g ton-¹.

Yield per hectare

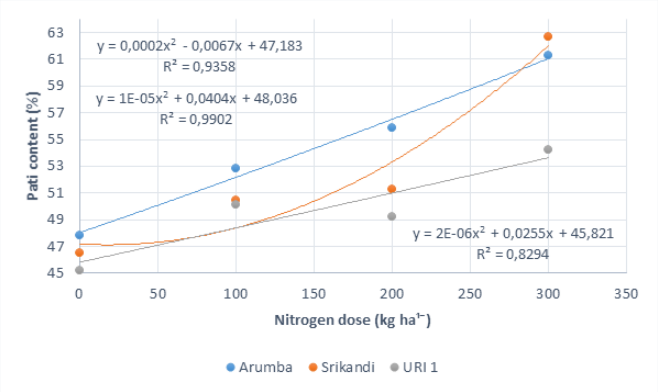
Table 10. Average Harvest Yield per Hectare Variety Treatment and N Fertilizer Dosage.

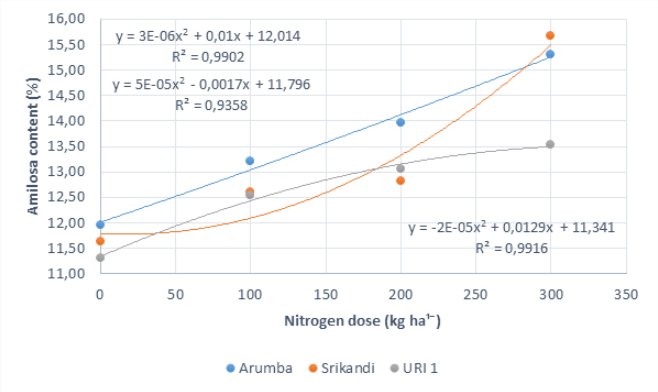
Observation parameters	Nitrogen dose (kg ha¯¹)	Varieties		
		Arumba	Srikandi	URI 1
Yield (t. hec-¹)	0	6,54 c	4,97 b	3,33 a
		A	A	A
	100	7,14 a	9,22 b	7,57 a
		A	B	B
	200	7,62 a	9,48 b	7,69 a
		AB	B	B
	300	8,49 a	9,75 b	9 ab
		B	B	C
	HSD Varieties (5%)		1,09	
	HSD Nitrogen (5%)		0,99	

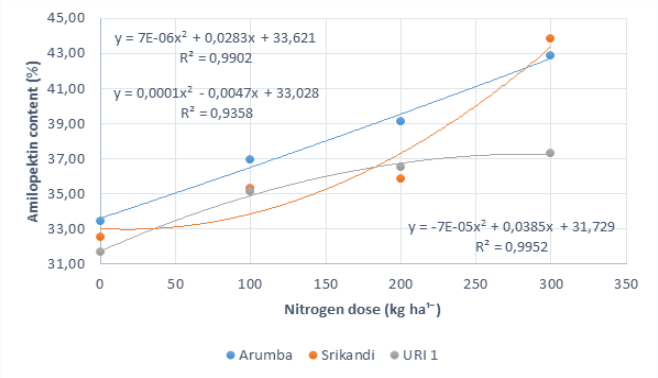
The average yield per hectare of glutinous corn is presented in table 16. The results of the analysis of yield variance show a real interaction with variety treatment and N fertilizer dose. It is known that as the N fertilizer dose increases, the yield increases in all varieties. The Srikandi

and URI 1 control varieties were significantly different with each dose of N fertilizer. The highest value of yield per hectare for the Srikandi variety was at a dose of 300 kg ha^{-1}, namely 9.75t. hec^{-1} followed by the URI 1 9 t. hec^{-1} and arumba variety 8.49 t. hec^{-1}.

Starch, Amylose and Amylopectin content tests.







The quadratic effect shows that increasing the dose of N fertilizer increases the amount of starch content up to the optimum dose and then decreases at the highest dose. For the arumba variety, the regression value (R^2) of the two variables was obtained at 0.9358, for the Srikandi variety the regression value (R^2) for the two variables was 0.9902, and for the URI 1 variety, the regression value (R^2) for the two variables was 0.8294. , the greater the regression value or the closer the value is to 1, it shows that the two variables are related, which means that the dose of N fertilizer has an effect on the analysis of the starch content produced. Analysis of the highest starch content in the Srikandi variety with a N fertilizer dose of 300 kg ha^{-1} was 62.67%, followed by the Arumba variety 61.26% and the URI 1 variety 54.23%. The lowest starch content was found in the URI 1 variety with a control N fertilizer dose of 45.23% compared to other treatments.

For the arumba variety, the regression value (R^2) for the two variables was obtained at 0.9902, for the Srikandi variety the regression value (R^2) for the two variables was 0.9358, and for the URI 1 variety, the regression value (R^2) for the two variables was 0.9916. , the greater the regression value or the closer the value is to 1, it shows that the two variables are related, which means that the dose of N fertilizer has an effect on the analysis of the amylose levels produced. Analysis of the highest amylose content in the Srikandi variety at a N fertilizer dose of 300 kg ha^{-1}, namely 15.67%, followed by the Arumba variety 15.32%. The lowest starch content in the control dose URI 1 variety was 11.31% compared to other treatments. In each variety, the amylose content with additional doses of N fertilizer always increases with each dose. So it can be seen that differences in varieties also affect the amylose content in sticky corn plants.

For the arumba variety, the regression value (R^2) for the two variables was obtained at 0.9902, for the Srikandi variety the regression value (R^2) for the two variables was 0.9358, and for the URI 1 variety, the regression value (R^2) for the two variables was 0.9952. , the greater the regression value or the closer the value is to 1, it shows that the two variables are related, which means that the dose of N fertilizer has an effect on the analysis of the amylopectin levels produced. Analysis of the highest amylopectin levels in the Srikandi variety for nitrogen application of 300 kg ha^{-1}, namely 43.87%, followed by the Arumba variety for nitrogen application of 300 kg ha^{-1}, namely 42.88%. The lowest amylopectin level was in the control dose of the URI 1 variety, namely 31.66% compared to other treatments.

IV. DISCUSSION

The growth of glutinous corn plants increases with increasing doses of nitrogen fertilizer, which is related to the function of nitrogen fertilizer, namely to stimulate plant vegetative growth and is an important ingredient in the preparation of amino acids, amides, nucleotides, nucleoproteins, as well as for cell division and enlargement in plant tissue. Hammad et al. (2018), stated that different doses of nitrogen fertilizer had an effect on the growth and yield of corn plants. The maximum plant height at the observation age of 49 DAP (107.78 cm) was observed when a dose of 300 kg N ha^{-1} was given, while the minimum plant height (21.11 cm) was recorded in the control treatment.

Providing nitrogen fertilizer increased plant height 5 times higher when compared to the control treatment (107.78 vs. 21.11). According to research by Mohamed Yousif M. Alsharifi et al. (2022), nitrogen fertilization at a dose of 300 kg N ha^{1-} on corn plants with a spacing of 20 cm gave the highest growth and yield results compared to doses of 250 kg N ha^{1-} and 200 kg N ha^{1-}.

The ability of plants to absorb nutrients for plant growth and development needs is influenced, among other things, by genetic factors. Different types of varieties have different genetic characteristics. In this case, different varieties have different nutrient requirements. The growth rate of a plant is determined by the interaction of genetic factors of the plant variety itself with the growing environment such as sunlight, soil type, temperature, water availability and altitude (Adimihardja et al. 2013; Pithaloka et al. 2015). According to Hokmalipur and Darbandi (2011), chlorophyll content depends on the availability of N in the soil which can be utilized by plants. The wider the leaves and the higher the chlorophyll content in the leaves, the greater the rate of photosynthesis so that the photosynthesis process runs more effectively and the accumulation of photosynthesis which is directed towards the formation of dry matter and plant height increases. Leaf area is directly proportional to the amount of sunlight captured by the leaf. Therefore, more photosynthesis products such as carbohydrates and food reserves and energy sources are formed. The appearance of different growth in leaf area between glutinous corn varieties is caused by differences in the speed of division, multiplication, and cell enlargement.

From the differences in plant growth rates, it is known that CGR is significantly influenced by differences in N fertilizer levels in each growth period. Mian, Ahmed, and Matin (2002), also reported that the CGR value increased with increasing doses of nitrogen fertilizer along with the plant growth and development phase. This finding is in accordance with Khaleque (2005). Hossain and Shahjahan (2008), argue that the CGR value is slow at the beginning of growth due to the incomplete number of leaves and the low percentage of sunlight interception. Net Assimilation Rate (NAR) is the ability of plants to produce assimilated dry matter per unit leaf area per unit time. NAR is influenced by the amount of solar radiation, the ability of leaves to photosynthesize, leaf area index, light distribution, and the amount of plant respiration.

According to research by Ali et al. (2002), explains that the cob length value can be increased significantly by applying nitrogen. Junaid et al. (2009), cob length was significantly influenced by differences in nitrogen levels, namely 10-30% higher than the control. Negash et al. (2021), observed that the combination of varieties and N fertilizer doses had a large influence on the length of corn cobs. Research by Debele & Taressa (2023), shows that the weight of cobs per corn plant is greatly influenced by the interaction between varieties and the dose of nitrogen applied. Mosisa et al. (2022), found that differences in corn cultivars significantly influenced cob weight per plant. It is known that nitrogen plays an important role in plant growth and development. The observations in this study are fully consistent with the findings of Raven et al. (1999) in Mamudu et al. (2017), that nitrogen is one of the constituent components of a number of compounds (proteins and nucleic acids) which have an important role in plant physiological processes.

According to research by Huang et al. (2022), the amylose content in four sorghum varieties increased along with increasing nitrogen fertilizer content. In accordance with research by Kaplan et al. (2019), when the influence of processing factors (fertilizer and irrigation) on the starch fraction was investigated, it was determined that the lowest amount of amylose was determined from the I100:100% and N1:100 kg ha^{1-} treatments while the highest amylose content was obtained from the application of I50:50% and N3:300 kg ha^{1-}. The amylose content increased with increasing fertilizer concentration, while the amylose content decreased with increasing irrigation rate. From the analysis of the starch, amylose and amylopectin content studied, it is in line with research by Huang et al. (2022), who observed the effect of nitrogen fertilizer dosage on the structure and physicochemical properties of starch in four sorghum varieties, found that nitrogen fertilizer dosage influenced the physicochemical properties of sorghum. The particle size increases with increasing nitrogen fertilizer dosage. A similar trend also occurred in amylose content. However, the proportion of amorphous structures in starch decreased with increasing nitrogen fertilizer dosage. Peak viscosity, final viscosity, gelatinization temperature, initial temperature, final temperature, and enthalpy increased significantly with increasing nitrogen fertilizer dosage.

Application of nitrogen fertilizer significantly improved the above parameters, all of which peaked at N3 (300 kg/ha urea). However, excess doses of nitrogen fertilizer (N4: 450 kg/ha urea) can significantly reduce the above indicators, thereby changing the physicochemical properties and structure of sorghum starch. Overall, nitrogen had a significant effect on the structure and physicochemical properties of sorghum starch.

V. CONCLUSION

1. The variety treatment and N fertilizer dosage showed a significant interaction effect on all growth parameters, except for the number of leaves at 42 DAP and leaf area at 14, 21, 35 and 49 DAT.

2. The variety treatment and N fertilizer dose showed a significant interaction effect on all yield parameters, except for ear length.
3. Variety treatment and N fertilizer dosage had an influence on the analysis of increasing starch, amylose and amylopectin content.
4. The Srikandi variety has a higher response to nitrogen fertilization than the Arumba and URI 1 varieties.
5. In the treatment with a fertilizer dose of N 300 kg ha^{1-} had the highest results in each observed parameter.

REFERENCES

[1] Adimihardja SA, Hamid G dan Rosa E. 2013. Pengaruh pemberian kombinasi kompos sapi dan fertimix terhadap pertumbuhan dan produksi dua kultivar tanaman selada (Lactuca sativa L.) dalam sistem hidroponik rakit apung. J Pertanian 4 (1 : 6-20) ISSN 2087-4936.

[2] Alaamer, S. A. & Alsharifi, S. K. (2020). Affecting mechanical on some growth characteristics for maize, SYN5018 cultivar. Plant Archives. 20(2), 1150-1155.

[3] Ali, J., J. Bakht, M. Shafi, S. Khan and W. Ali. 2002. Uptake of nitrogen as affected by various combination of nitrogen and phosphorous. Asian J. Plant Sci. 1(4): 367-369.

[4] Alsharifi.M., Atab,H.A and Alsharifi.S.K.Alwan. 2022. Response of corn at different levels of nitrogen fertilizer and cultivation distances. IOP Conf. Series: Earth and Environmental Science 1060 (2022) 012134. doi:10.1088/1755-1315/1060/1/012134 .

[5] Alsharifi, S. K. A., Ghali, A. A., & Hamzah, I. J. (2021a). A study some growth characteristics for maize, Bohooth 106 variety under affecting mechanical for machine (moldboard plow type). In IOP Conference Series: Earth and Environmental Science (Vol. 735, No. 1, p. 012007). IOP Publishing.

[6] Debele, M.; Taressa, B. Urea split application to maize (Zea mays L.) growth stages of medium maturities, influenced on grain yield and parameter for yield at bako, East Wollega, Ethiopia. Int. J. Agron. 2023, 2023, 6673773.

[7] Hammad, HM, Abbas, F., Ahmad, A., Farhad, W., Wilkerson, CJ, dan Hoogenboom, G. 2018. Evaluasi waktu dan tingkat penerapan nitrogen untuk mengoptimalkan pertumbuhan dan perkembangan jagung serta memaksimalkan hasil.Agronomi. J.110, 565–571. doi: 10.2134/agronj2017.08. 0466

[8] H. Negash, W. Wondimu, A. Abraham, and B. Zenabu, "Maize yield improvement by optimal rate and timing of nitrogen fertilizer application in Southwest Ethiopia," AGBIR, vol. 37, no. 3, pp. 127–138, 2021.

[9] Hokmalipur, S. and Darbandi, M. H. 2011. Effect of Nitrogen Ferlizer on Chlorophyll Content and Other Leaf Indicate in Three Cultivar of Maize (Zea mays L.). World Applied Sciences Journal, 15 (2), 1780-1785.

[10] Hossain, A., & Shahjahan, M. (2008). Grain quality evaluation of the major varieties or cultivar of maize. Research Report for 2006-07 (pp. 1-6). Post Harvest and Technology Division, Bangladesh Agricultural Research Institute, Gazipur.

[11] Huang, Y.; Tian, L.; Yang, Q.; Zhang, M.; Liu, G.; Yu, S.; Feng, B. Nitrogenous Fertilizer Levels Affect the Physicochemical Properties of Sorghum Starch. Foods 2022, 11, 3690. https://doi.org/10.3390/ foods11223690

[12] Junaid, M., H. Khan, A. Ali, M. Ahmad and F. Raziq. 2009. Response of various maize cultivars to different levels of Nitrogen against Bipolaris maydis shoemaker under natural epiphytotic conditions. Sarhad J. Agric. 25(2): 243-249.

[13] Khaleque, M. A. (2005). Study on growth and yield of modern wheat varieties in different management practices (pp. 65-84). PhD Thesis. Institute of Biological Sciences, University of Rajshahi, Bangladesh.

[14] Kaplan, M.; Karaman, K.; Kardes, Y.M.; Kale, H. Phytic acid content and starch properties of maize (Zea mays L.): Effects of irrigation process and nitrogen fertilizer. Food Chem. 2019, 283, 375–380.

[15] Mamudu D, Mensah GWK, Borketey EB. 2017. The responses of three maize varieties to four levels of nitrogen in the forest-transitional zone of Ghana. Journal of Biological Agriculture Healthcare 7(14), 79-88.

[16] Mian, M. A. K., Ahmed, A., & Matin, A. (2002). Growth, yield and economics of hybrid maize as affected by rate and time of nitrogen application. Bangladesh Journal of Agricultural Research, 27, 41-46.

[17] Pithaloka, et al. 2015. Pengaruh Kerapatan Tanaman Terhadap Pertumbuhan dan Hasil Beberapa Varietas Sorgum (Sorghum bicolor (L.) Moench. J.Agrotek Tropika, ISSN. Vol. 3 No. 1: 56-53.

[18] Raven, P. H., Evert, R. F. & Eichhorn, S. E. (1999). Biology of plants. New York: W.H. Freeman and Company. 88pp.

[19] Tengah, J., Tumbelaka, S dan Toding, M. 2017. Pertumbuhan dan Produksi Jagung Ketan Lokal (Zea Mays Ceratina Kulesh) Pada Beberapa Dosis Pupuk NPK. J. Ilmiah Fakultas Pertanian Universitas Sam Ratulangi, 1(1).

[20] W. Mosisa, N. Dechassa, K. Kibret, H. Zeleke, and Z. Bekeko, "Efects of timing and nitrogen fertilizer application rates on maize yield components and yield in eastern Ethiopia," Agrosystems, Geosciences and Environment, vol. 5, no. 4, Article ID e20322, 2022.