Response of corn (*Zea mays* L) yield to leaf pruning under the cob

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Abstract. The corn plant is one of the most important food crops, in addition to wheat and rice. In addition to the main source of carbohydrates, it is also an alternative food corn is also grown as animal feed (forage and cob). One of the efforts that can be done to increase corn productivity, among others, by modifying plant growth such as pruning. The purpose of this study was to determine the effect of pruning leaves under the cob to increase corn production. Using a complete random design (RAL) consisting of 4 treatments (without pruning; 2-Leaf pruning; 4-Leaf pruning and 6-leaf pruning, each treatment is repeated 5 times. The results showed that the pruning of the lower leaves of the cob had no significant effect on the production components. In the treatment of 6 leaves pruning gives the highest production of 119.374 g, pruning 2 leaves 104.082 g, pruning 4 leaves 95.02 g and without pruning obtained 84.5 g. From this study it can be concluded that pruning up to 6 leaves under the cob has no effect on corn production. Pruning leaves under the cob at 65 days after planting has the potential to be used as quality animal feed

1 Introduction

Corn plant (*Zea mays L.*) is the main food crop commodity after Rice [1-3]. The Corn described further contains carbohydrates that exceed rice. Corn contains fiber and the glycemic index value is lower than rice [4]. According to [1], corn commodities need to be separated between corn as a staple food and industrial raw materials. This difference is evident, both in the production system and in the consumption system. Corn for staple food is generally local corn.

The increasing rate of population growth resulted in increased demand for corn. This is a challenge for the government to continue to increase corn yields. Intensification pattern needs to be done to increase the productivity of the land by applying the right cultivation technology. Another cultivation technology that can be done to increase corn yield is to regulate the interception and absorption of solar radiation energy. The growth and production of plants is directly affected by photosynthesis, where the main factor for the photosynthesis process is sunlight. Plant yield is closely related to leaf photosynthesis rate and active leaf area which plays an important role in carbon fixation [3]. The middle Leaf

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has the most important role of the other leaves because its surface is larger and actively participates in photosynthesis [4].

The leaves of the corn plant serve as a place of photosynthesis that produces photosynthate which is then used in the formation of plant parts. Photosynthesis in leaves is influenced by many factors such as leaf age, leaf position, but it is also influenced by environmental factors such as light, temperature, nutrients, and water availability [5]. In the process of seed formation and filling, each leaf has a different portion, depending on the distance between the leaf and the cob. The leaves closer to the cob have a greater role in the formation and filling of the cob of the corn plant.

Pruning leaves is one way to adjust the balance of the plant so that it can provide good growth. Pruning leaves in corn plants, especially unproductive leaves, can reduce photosynthetic competition between cobs and other sink organs [6]. Further stated by [7], that the magnitude of the effect of leaf pruning on crop yields depends on the number of leaves trimmed, the location of the leaves on the stem and the growth period of corn plants. that light plays a role in the synthesis and translocation of assimilates from mature leaves to harvestable plant organs.[8]**.** This unproductive leaf pruning is an opportunity for utilization as forage feed for beef cattle [9]. pruning is a particular disposal part for a control size, shape as well as stimulate the growth and production of plants. Benefits of pruning plants so that the photosynthesis produced is used for seedling development from the above description can be formulated that the problem of corn production can still be improved. Efforts to increase production can be done by modifying through pruning. This study aims to determine the effect of pruning leaves under the cob to increase corn production.

2 Method

This study was conducted at the dissemination Laboratory land of the Agricultural Technology Assessment Center of North Sulawesi (124^0 50' BT and 1^0 30' – 1^0 40' LU), an altitude of 1 m above sea level, lasted for 6 months from March to August 2020. The material used is hybrid corn seed varieties *Nakula Sadewa* (NASA), mixed planting media 80% soil and 20% organic fertilizer. polybag 50x50 cm. This study was prepared using complete random design (RAL), 4 treatments with 5 replications.

Working procedure:

1. Preparation of hybrid corn seed variety *Nakula Sadewa* (NASA)
2. Preparation of planting media that is 80% soil and 20% organic fertilizer
3. Filling the soil to the growing medium (polybag 50x50 cm) to 80% part.
4. Planting corn seeds 2 pcs / polybag. 10 days after planting, thinning is carried out.
5. Leaf pruning is carried out simultaneously at 65 days after planting

Treatment tested: without pruning, pruning 2 leaves under the cob, pruning 4 leaves under the cob, pruning 6 leaves under the cob. Observed parameters:

1. Cob weight (gr): weighing of whole cobs after harvesting.
2. Cob Diameter (cm): measured in the middle of the cob with a measuring tape.
3. Weight of cob skin (gr): whole skin that wraps the cob
4. Cob bar weight (gr): weighing bating cob after corn grains
5. Weight Shelled Corn Grains (gr); weighing all corn kernels after drying

Data were analyzed to see the effect of treatment on corn production. For observational data were analyzed descriptively quantitative using absolute data and relative. Step analysis to test the impact of treatment of corn production factor Varitas Nasa conducted analysis of variety fingerprint (Anova) using Excel device. If the results of Anova showed a real difference between the treatments introduced, then the further analysis with the honest real difference Test (BNJ) at 5% level [10].

3 Results and discussion

3.1 Cob Weight

The cobs on the corn are the inside of the female organ where the spikelet's sit attached. The term is used to refer to all parts of the female corn "corn fruit". Cobs wrapped by *kelobot* (corn peel). Table 1. Load the results of measuring the weight of the cob.

Table 1. Cob weight measurement (grams).

Replication	Treatment				∑
	Without Pruning	Pruning 2 Leaves	Pruning 4 Leaves	Pruning 6 Leaves	
U1	129.00	193.00	101.80	150.25	574.05
U2	92.00	104.50	158.00	146.70	501.20
U3	116.60	129.33	115.40	187.50	548.83
U4	121.50	144.75	105.00	163.25	534.50
U5	129.17	133.00	154.70	112.33	529.20
$\bar{x}$	117.654 ^{ns}	140.916 ^{ns}	126.98 ^{ns}	152.006 ^{ns}	
∑	588.27	704.58	634.9	760.03	
Min	92.00	104.50	101.80	112.33	
Max	129.17	193.00	158.00	187.50	
STD	15.29	32.60	27.30	27.35	

Note: ns was non-significant

Based on Table 1, it is known that the treatment without pruning leaves (control) produces the lowest cob weight in the cob weight range of 92 g to 129.17 g with an average of 117.654, 15.29, followed by treatment, pruning 4 leaves below the cob produces a cob weight in the range of 101.80 g to 158.00 gr with an average of 126.98, 27.30, followed by the pruning treatment of 2 leaves under the cob produces weight kelobot in the range of 104.50 g to 193.00 gr with an average of 140.916 $\pm$32.60 and the highest weight of the cob produced in the treatment of pruning 6 leaves under the cob in the range of 112.33 gr to 187.50 gr with an average of 152.006 $\pm$27.35.

Table 2. Analysis of the effect of treatment diversity on the weight of cobs.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3439.57	3	1146.523	1.64384805	0.218927681	3.238871517
Within Groups	11159.41	16	697.463			
Total	14598.98	19				

Note: FHIT < Ftab pruning leaves under the cob gives the same effect on the weight of the cob

Based on the results of diversity analysis (Anova) on all treatments tested (Table 2), it is known that the treatment gives the same effect on the weight of the cob. In the operational level, this analyst shows that the pruning treatment of 2 to 6 leaves under the cob has no significant effect on the weight of the cob. When the comparison between treatment P0: P1 there is an increase of 23.262 g/ cob (19.77%). without pruning: pruning 4 leaves there was an increase of 9.362 g/cob (7.93%). without pruning: pruning 6 leaves there was an increase of 34,352 g/cob (29.20%). According to [11], leaf pruning means the removal of plant organs, therefore the greater the pruning has the effect of reducing the dry weight of the

plant. With the pruning of leaves that are not actively photosynthesizing, the assimilate results transferred to the cob will be greater, so that by pruning leaves that are not actively photosynthesizing and leaving leaves that are actively photosynthesizing result in a considerable increase in cob weight compared to the number of complete leaves without pruning, because pruning leaves and male flowers followed by an increase in cob weight, the total dry weight of the plant is not significantly different.

3.2 Cob Diameter

The results of measurements of the diameter of the cob are shown in Table 3. The lowest diameter data on the treatment of trimming 4 leaves under the cob obtained data range 11.25 to 13.00 cm with an average of 12.13±0.71, followed by treatment without pruning range between 11.75 to 13.00 cm with an average of 12.26, 0.54, followed by treatment pruning 6 leaves under the cob obtained data range 10.83 to 13.50 cm with an average of 12.79, 1.11. and the highest in the treatment of pruning 2 leaves under the cob obtained data cob diameter ranging from 11.63 to 14.33 cm with an average of 13.081.21. [12] state that the diameter of the cob is significantly affected by nitrogen supplementation, but not affected by the degree of pruning. Pruning three leaves below at 50 HST produces the highest value of cob length. The lower leaves are often sinks because they are shaded by the leaves above them so that their photosynthetic capacity decreases [13].

Table 3. Measurement of the diameter of the cob (cm).

Replication	Treatment				∑
	Without Pruning	Pruning 2 Leaves	Pruning 4 Leaves	Pruning 6 Leaves	
U1	11.75	14.33	11.90	13.00	50.98
U2	13.00	11.63	13.00	13.25	50.88
U3	12.20	12.75	11.80	13.50	50.25
U4	11.75	12.38	11.25	13.38	48.76
U5	12.58	14.33	12.70	10.83	50.44
$\bar{X}$	12.26^{ns}	13.08^{ns}	12.13^{ns}	12.79^{ns}	
∑	61.28	65.42	60.65	63.96	
Max	13.00	14.33	13.00	13.50	
Min	11.75	11.63	11.25	10.83	
STD	0.54	1.21	0.71	1.11	

Note: ns was non-significant

The results of diversity analysis (Anova) in Table 4 showed that the pruning treatment of 2 to 6 leaves under the cob statistically gave the same response to the diameter of the cob. If the average data between treatments compared with without pruning obtained information: without pruning: pruning leaves, there is an increase in the diameter of the cob 0.82 cm (6.69%). without pruning: pruning 4 leaves there was a decrease in the diameter of the cob 0.1 cm and without: pruning 6 leaves there was an increase in the diameter of the cob 0.53 cm (4.32%).

Table 4. Analysis of the variety of measurements of the diameter of the cob.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3.027	3	1.009325	1.1561	0.3570	3.238871517
Within Groups	3.96	16	0.87297			
Total	16.99	19				

Note: Fhit < Ftab Leaf pruning under the cob gives the same effect on the diameter of the cob

3.3 Weight of cob skin

Cob skin has the potential to be a source of fiber feed as a byproduct of corn farming. The results of the cob skin measurements are shown in Table 5. The lowest cob skin weight measurement data obtained in the treatment of pruning 4 leaves under the cob is in the range of 10.60 to 16.00 g/cob with an average of 13.40, 2.14, followed by P3 treatment pruning 6 leaves under the cob is in the range of 12.50 to 15.50 g with a rataan14.47± 1.39, followed by treatment pruning 2 leaves P0 without pruning, data were obtained in the range of 13.00 to 24.00 g with an average of 18.81±4.87.

Table 5. Cob skin weight measurement.

Replication	Treatment				∑
	Without Pruning	Pruning 2 Leaves	Pruning 4 Leaves	Pruning 6 Leaves	
U1	24.00	13.67	12.40	12.50	94.07
U2	13.00	12.25	16.00	15.50	18.81
U3	15.40	15.50	10.60	13.50	94.07
U4	23.50	21.25	13.00	15.50	18.81
U5	18.17	15.50	15.00	15.33	94.07
$\bar{x}$	18.81	15.63	13.40	14.47	
∑	94.07	78.17	67.0	72.33	
Max	24.00	21.25	16.00	15.50	
Min	13.00	12.25	10.60	12.50	
STD	4.87	3.42	2.14	1.39	

Results of analysis of various prints (Table 6), shows that the treatment of pruning 2 to 6 leaves under the cob gives the same effect on the weight of the bark of the cob. But based on pruning data 2 to 6 leaves under the cob there is a tendency to decrease the weight of the bark of the cob.

Table 6. Skin weight diversity analysis (gram).

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	82.2753	3	27.4251	2.6179422	0.08664742	3.23887151
Within Groups	167.6132	16	10.47582			
Total	249.8885	19				

Note: ns was non-significant

3.4 Cob Rod Weight

The stem of the cob is the seat of the built grain of corn. The weight measurement data of cob rods are shown in Table 7. Based on the data tabulation, it can be seen that the overall pruning treatment of 2 to 6 *lelai* leaves under the cob has increased the weight of the cob stem. The highest Data was obtained on the treatment of pruning 2 leaves under the cob with a range of 13.25 to 23.00 gr or an average of 19.52±4.10, followed by treatment of pruning 6 leaves under the cob with a range of 14.00 to 21.50 g or with an average of 17.62±2.77, the lowest data treatment without pruning with a range of 11.00 to 17.00 cm or with an average of 15.03±2.37. Cutting leaves in different ways has varying effects on dry matter aggregation and yield. In the parameters of total fresh weight of plants and total dry weight of plants that occur in all treatments including treatment without pruning there is no significant difference [14].

Table 7. Cob Rod weight measurement (gr).

Replication	Treatment				∑
	Without Pruning	Pruning 2 Leaves	Pruning 4 Leaves	Pruning 6 Leaves	
U1	16.50	23.00	12.40	18.50	70.40
U2	11.00	13.25	20.00	16.33	60.58
U3	17.00	17.83	18.00	21.50	74.33
U4	15.50	23.00	13.50	17.75	69.75
U5	15.17	20.50	18.00	14.00	67.67
x̄	15.03	19.52	16.38	17.62	
∑	75.17	97.58	81.90	88.08	
Max	17.00	23.00	20.00	21.50	
Min	11.00	13.25	12.40	14.00	
STD	2.37	4.10	3.26	2.77	

Analysis of variety prints (Table 8) shows that the treatment has the same effect on the weight of the cob Rod. Overall, based on the average of each treatment showed pruning leaves 2 to 6 leaves under the cob showed an increase in the weight of the cob stem compared with treatment without pruning.

Table 8. Analysis of the variety of weights of cob rods (g).

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	54.4237	3	18.1412	1.7810036	0.19127613	3.238871517
Within Groups	162.975	16	10.1859			
Total	217.399	19				

Note: ns was treatment gives the same effect on the weight of the cob Rod (Fhit<Ftab)

3.5 Weight Shelled Corn Grains

Corn grains are the main result of corn cultivation. From the grains of corn make corn as the most important carbohydrate producing plants in Indonesia after Rice. At this time corn grains have become an important component as animal feed. Other uses of corn as a raw material for food oil and cornstarch, corn is also a raw material for the pharmaceutical, cosmetic and chemical industries.

Table 9. Weight shelled corn grains (g).

Replication	Treatment				∑
	Without Pruning	Pruning 2 Leaves	Pruning 4 Leaves	Pruning 6 Leaves	
U1	89.00	154.33	75.00	119.00	437.33
U2	67.00	73.75	115.00	114.17	369.92
U3	83.80	95.33	86.60	152.00	417.73
U4	88.00	100.00	77.50	129.00	394.50
U5	94.70	97.00	121.00	82.70	395.40
x̄	84.50^{ns}	104.08^{ns}	95.02^{ns}	119.37^{ns}	
∑	422.5	520.41	475.1	596.87	
Max	94.70	154.33	121.00	152.00	
Min	67.00	73.75	75.00	82.70	
STD	10.53	29.95	21.52	25.15	

Note: ns non-significant

Based on tabulated data Table 9, pruning treatment 2 to 6 leaves under the cob there is a tendency to increase the weight of corn production *pipil*. The highest production was achieved in the treatment of pruning 6 leaves under the cob was in the range of 82.70 to 152.00 g, 119.37 average 25.15, followed by treatment of pruning 2 leaves under the cob in the range of 73.75 to 154.33 g average 104.00, 29.95, followed by treatment of pruning 4 leaves under the cob in the range of 75.00 to 121.00 grams average 95.20 21.52 and the lowest in the treatment of without pruning in the range of 67.00 to 94.70 g average 84.50, 10.53.

The results of the analysis of variety prints (Table 10), showed that the treatment had the same effect on the weight of corn grains (Fhit<Ftab). Tracing by comparing the treatment of without pruning with other treatments, obtained information: without pruning: pruning 2 leaves under the cob increased 19.5 g (23.08%) the weight of corn grain *pipil*. without pruning: P2 pruning 4 leaf *hedai* under the cob raising the grain weight of corn kernels 10.7 g/cob (12.66%) and without pruning: pruning 6 leaves under the cob raising the grain weight of corn kernels 34.87 g/cob (41.26%). According to [15] that pruning ears and produce the highest planting seed production and weight of 100 seeds. Pruning leaves at the top of the ear produce a lower number of seeds per row. Further stated [16], found that hybrid varieties have a different ability to sustain a decrease in seed weight when the source-sink ratio changes

Table 10. Variety Fingerprint Analysis Weight Measurement Shelled Corn Grains.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3274.254	3	1091.418	2.07550305	0.143820169	3.238871517
Within Groups	8413.714	16	525.8571			
Total	11687.97	19				

Note: ns was treatment gives the same response to the weight of corn grains (Fhit < Ftab)

4 Conclusion

Based on the results of observations and statistical analysis, it can be concluded that pruning up to 6 leaves under the cob does not negatively affect corn production. Leaves under the cob at 65 days after planting can potentially be used as forage quality animal feed.

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