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Effect of time and level of detopping on grain and fodder yield of maize (*Zea mays* L.)

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ABSTRACT

In a field experiment conducted during 2018-2019 at Research field, Department of Crop Physiology and Ecology, Hajee Mohammad Danesh Science and Technology University, Dinajpur the effect of detopping on grain and fodder yield of maize was studied. The single factor experiment was laid out in a randomized complete block design consisting of ten treatments viz. T_0 – control (no detopping), T_1 (detopping top 3 leaves), T_2 (detopping top 4 leaves), T_3 (detopping top 5 leaves) at 5 days after silking, T_4 (detopping top 3 leaves), T_5 (detopping top 4 leaves), T_6 (detopping top 5 leaves) at 10 days after silking, T_7 (detopping top 3 leaves), T_8 (detopping top 4 leaves), T_9 (detopping top 5 leaves) at 15 days after silking with three replications. The results revealed that, different stages and different levels of detopping in maize significantly influenced the growth parameters and fodder yield but the treatments did not significantly reduce grain yield compared with control. Detopping at different days after silking and different levels had no influence on first cob height, chlorophyll content, light intensity in crop canopy, canopy temperature, length of cob, girth of the cob, number of grain rows cob^{-1}, grain number row^{-1}, grain number cob^{-1}, grain yield m^{-2}, single cob weight, weight of hundred grains, grain yield, and stover yield. A significantly reduced number of leaves per plant was observed with T_4 (detopping with 3 leaves at 10 days after silking) at 20 days after silking and with T_1 (detopping with 3 leaves at 5 days after silking) at 30 days after silking. Leaf area was significantly reduced at T_4 (detopping with 3 leaves at 10 days after silking). The highest fodder yield was obtained with T_3 (detopping with 5 leaves at 5 days after silking) which was 0.783 kg fodder m^{-2}. As no significant yield reduction was observed with various times and levels of detopping so it was concluded that maize plants can be detopped up to 5 leaves at 15 days after silking without significant reduction in yield.

***Key Words**: Detopping, Cob, Maize, Grain yield and Fodder*

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I. Introduction

The importance of maize (*Zea mays* L.) as a grain crop in Bangladesh is increasing rapidly. Maize fits well in our existing cropping pattern (Quasem, 1999). It has become part of significant diversified and intensive cropping activities (Kaul and Rahman, 1983). The demand for it is rising steadily, and it is emerging as a crucial cereal crop in Bangladesh due to its impressively high production and versatile applications (Islam and Kaul, 1986). Therefore, it is evident that farmers are becoming more interested in maize cultivation. Cultivating hybrid maize varieties can offer a practical solution by providing a balanced supply of fodder and grain. Maize leaves serve as high-quality forage for ruminant animals. Maize leaves are an essential fodder source in South and Southeast Asia (Dowswell et al., 1996). Fodder scarcity is acute in tropical regions during the Rabi and early Kharif seasons. Harvesting maize leaves for fodder could prove advantageous for farmers.

Among cultivation practices, detopping of maize is new to farmers. Detopping is a practice in agriculture where the terminal portion of a plant, typically from the uppermost node, is nipped or removed. The purpose of this technique is to enhance crop yield by optimizing the functioning of the remaining leaves. Detopping enhances plant growth by reducing unnecessary growth, minimizing mutual shading of leaves, improving light interception, increasing nutrient uptake, and diverting nutrients to reproductive parts for better source-sink relationships and improved cob development (Esechie and Al-Alawi, 2002). Removal of maize tassel can significantly alter light penetration within the crop canopy, particularly when dealing with C_4 plants, which have high light requirements. The act of removing the tassels may lead to increased light availability for the remaining plant parts, influencing overall growth and yield. The interplay between defoliation and tassel removal can impact the allocation of assimilates between reproductive and vegetative organs. Adhikari (1990) concluded that up to 75% from top of the plant could be detasseled for fodder use.

The spatial arrangement of every leaf relative to the position of the ear and the efficiency of photosynthesis of a variety determine the rate of translocation of photosynthe to the cob. The two leaves above the cob and two below the cob contribute almost 50% of the accumulated dry matter in the ear (Allison and Watson, 1966). Optimal time of detopping crucial for lodging and ensuring sufficient forage while maintaining grain production (Usman et al., 2007). Defoliation of hybrid maize at later developmental stages had reduced grain yield (Hicks et al., 1977). When defoliation occurs after the cob has developed to some extent, the plant benefits from the remaining photosynthetic activity of the leaves, resulting in increased seed production compared to leaves defoliated earlier. If detopping does not impact grain production, it could be economical to boost yield while also managing lodging due to excessive vegetative growth and providing green fodder for animals without compromising grain yield. The information on optimum time and level of detopping of maize leaves is very little in Bangladesh. Keeping in view the above consideration the present investigation was conducted to know the effect of time and levels of detopping on growth and some physiological traits of maize, and to find out the effect of time and levels of detopping on grain and fodder yield of maize.

II. Materials and Methods

The experiment was carried out at the research field of the Crop Physiology and Ecology Department, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, from December 2018 to June 2019. The experimental field was a medium high land. It consisted of non-calcareous dark gray floodplain soil. The soil was sandy loam belonging to the Order Inceptisol.

The experiment was conducted following randomized complete block design (RCBD) with ten treatments and three replications. Unit plot size was 2.4 m × 2 m with row-to-row distance of 60 cm and plant-to-plant spacing of 50 cm. Treatments included three different levels or heights of detopping on three different days after silking with a single control (no detopping). The details of treatments were as below-

T_0: Control (No detopping)
T_1: Detopping with 3 leaves at 5 days after silking
T_2: Detopping with 4 leaves at 5 days after silking
T_3: Detopping with 5 leaves at 5 days after silking
T_4: Detopping with 3 leaves at 10 days after silking
T_5: Detopping with 4 leaves at 10 days after silking
T_6: Detopping with 5 leaves at 10 days after silking
T_7: Detopping with 3 leaves at 15 days after silking
T_8: Detopping with 4 leaves at 15 days after silking
T_9: Detopping with 5 leaves at 15 days after silking

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Seeds of hybrid maize variety PAC293 were sown on December 1, 2018. Source of seeds was Advanta seed co, Thailand (former: Pacific seed co., Thailand). The experimental field was prepared properly with a disc plough followed by secondary tillage by harrowing and laddering until a good tilth condition of the soil was obtained. A fertilizer dose of 86, 26, 41, 19, 6, 1, 0.5 kg ha^{-1} N, P, K, S, Mg, Zn, B respectively was applied as urea, Triple Super Phosphate (TSP), Muriate of Potash (MoP), Gypsum, Magnesium Sulfate, Zinc Sulfate and Boric acid (FRG, 2012).

Silking date was determined by observing and when 50% of maize plants from each plot bore the silking cob and that day was recorded as silking date. Detopping operations were done according to the treatment combination. When 50% of the plant completed silking detopping operations were applied at 5, 10 and 15 days after silking. Maize plants were detopped up to 3, 4 and 5 leaves using a sharp sickle. Detopped leaves along with tassel and stalk were taken out of the field for weighing. Harvesting was done at 5 May 2019. It was done manually by hand picking at physiological mature stage when the sheath of the cob was completely dried, as the husk had turned yellow. The harvested cobs from each plot were husked and sun dried separately until seeds reached 16 to 17 percent moisture content. The cobs were shelled manually by single cob maize sheller. After that, the seeds were cleaned and again sun dried till seed moisture content reached 12 %.

From each plot five maize plants were randomly selected and earmarked for data collection. From the five earmarked plants, the growth parameters recorded were first cob height (from the base of the plant up to the first cob-bearing node), number of leaves $plant^{-1}$, leaf area $plant^{-1}$, SPAD value, light intensity and canopy temperature. Data recorded on yield contributing characters were length of cob, girth of the cob, number of grain rows cob^{-1}, grain number row^{-1}, grain number cob^{-1}, single cob weight, weight of 100 grains, grain yield m^{-2}, grain weight per cob, stover yield and green fodder yield from each plot. Green fodder yield was obtained by weighing the fresh leaves with the stalk obtained after detopping treatment in the field and converted in kg m^{-2}. Data of growth and yield components and yield were subjected to ANOVA as outlined for randomized block design. Statistical significance was tested by F-test values at 0.05 level of probability and Tuckey's test was carried out whenever the effects were significant.

III. Results and Discussion

First cob height (cm)

The data on first cob height collected at 20 days after silking did not provide any significant variation (Table 01). The highest cob height at 20 days after silking was found at T_2 (detopping with 4 leaves at 5 days after silking) which was 123.1 cm and the lowest cob height was found in control T_0 (no detopping) which was 115.9 cm. Similarly, first cob height at 30 days after silking did not show any significant variation among the treatments (Table 01). At 30 days after silking, the highest value was found in T_2 (detopping with 4 leaves at 5 days after silking), which was 122.8 cm and the lowest cob height was 115.6 cm in control T_0 (no detopping).

Although the tops of maize plants were removed it did not affect the height of cob significantly but percent change over control showed that cob heights were higher than control (no detopping) when detopping treatment was given. This may be due to reduction of apical dominance which accelerated the growth of inter nodal region below the first cob resulting in greater cob height. These results are contradictory to the findings of Srisailam (2010) who found that the highest plant height was obtained in control (no detopping) over tassel removal with 2, 4, 6 and 8 top leaves removal. In another study Khaliliaqdam et al. (2012) mentioned that leaf defoliation in maize affected both plant height and cob height.

Number of leaves $plant^{-1}$

During the experimentation, the number of leaves at 20 and 30 days after silking expressed significant difference. Maximum number of leaves at 20 days after silking was found in T_0 (control i.e. no detopping) which was 10.13 and minimum was in T_6 (detopping with 5 leaves at 10 days after silking) which was 5.67 leaves per plant (Table 01). Leaf number was highest in control as there was no detopping and lowest in case removal of 5 leaves along with tassel. At 30 days after silking maximum leaf number was found in T_0 (control i.e. no detopping), which was 10.07 and minimum leaf was in T_9 (detopping with at 15 days after silking) with 5.60 leaves per plant (Table 01).

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Leaf numbers were reduced due to removal of top leaves as well as gradual falling of older leaves. Leaves are the source of assimilation and contribute to the final cob and grain weight. Therefore, numbers of leaves is critical for the maximum yield. Wilhelm et al. (1995) mentioned that, on average 5.4 leaves remained above the ear for the control group and 1.4 for the treatment group, i.e. tassel and four leaves removal group following the treatment operation. This decline was linearly associated with the number of leaves removed.

Leaf area plant^{-1} (cm^2)

Analysis of data regarding leaf area plant^{-1} revealed that it was significant with the treatments. During the experimental period leaf area at 20 days after silking was maximum 6478.76 cm^2 with T_0 (no detopping) and minimum 3862.49 cm^2 with T_9 (detopping with 5 leaves at 15 days after silking) (Table 01). Highest leaf area plant^{-1} found with no detopping at T_0 was statistically similar to those of T_1, T_2, T_4, T_5, T_7 and T_8. This means earlier detopping operation with minimum number of leaves compared to other treatments did not reduce leaf plant^{-1}. Decrement in leaf area was due to leaf removal and death of mature leaves over time.

This result was in line with Barimavandi et al. (2010) who reported that maximum leaf area was observed in control (without leaf removal) and least was observed for lower leaf removal. Similarly, Emam and Taddayon (1999) reported that leaf area was highest in the absence of detopping, which was higher over detopping at one, two, or three leaves above the ear, accordingly. Leaf area index was reduced by 0.4 when 2 leaves and 0.6 units when 3 leaves were removed along with complete detasseling according to Esechie and AL-Alawi (2002).

SPAD chlorophyll meter readings

SPAD chlorophyll meter readings did not show any significant relationship between SPAD value of cob bearing leaf and different treatments in both 20 and 30 days after silking. Thus, the chlorophyll content of cob bearing leaf was not affected by source restriction. Although maximum mean SPAD reading at 20 days after silking was found to be 59.33 in T_4 (detopping with 3 leaves at 10 days after silking) and minimum mean SPAD reading was 51.37 in T_7 (detopping with 3 leaves at 15 days after silking) but they were statistically similar (Table 01). Accordingly, 30 days after silking the SPAD reading from cob bearing leaves did not show statistically different values.

Chlorophyll meter, i.e. SPAD meter is used to measure the chlorophyll content in plant leaves. Leaf chlorophyll content and leaf N content are closely related. A SPAD value of 35 indicates a critical N level. Any value below it will indicate that the plant is deficient in N. These results were similar to the findings of Bijanzadeh and Emam (2010) who reported source restriction did not affect flag leaf chlorophyll content. On the other hand, Srisailam (2010) removed top 2, 4, 6, 8 and 10 leaves, each time with tassel and found maximum chlorophyll content in 3rd to 10th leaf at 70 DAS.

Light intensity in crop canopy (lux)

Data on light intensity in crop canopy indicated no significant variation among treatments both at 20 and 30 days after silking. Light intensity in experimental plot at 20 DAS was maximum of 7211 lux for T_6 (detopping with 5 leaves at 10 days after silking) and minimum of 4616 lux for T_0 (no detopping) (Table 01). However, this difference in light intensity merged over time and at 30 days after silking all the treatment plots showed statistically similar light intensity.

Light is the energy source for the plant to capture it by photosynthesis. As maize is C_4 plant, it will produce more photosynthate with increasing light intensity. Heidari (2012) also mentioned that the upper leaves are more efficient in absorbing light and photosynthesis than the lower ones. Light energy is the driving force of photosynthesis, which determines almost entirely crop productivity (Keating and Carberry, 1993). Pearce et al. (1965) and Williams et al. (1965) reported there exists a direct relationship between LAI and light interception. Plants increase their rate of photosynthesis by capturing more sunlight. This happens until most of the sunlight hitting the leaves is absorbed (Gardner et al., 1985). Once that point is reached, adding more leaves shades the lower ones, reducing overall photosynthesis instead of helping.

Canopy temperature (°C)

Measured canopy temperature at 30 days after silking was not significantly changed with detopping operation. Canopy temperature at 30 days after silking was highest at 22.39°C for T_9 (detopping with 5

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leaves at 15 days after silking) (Table 01). It was similar with T_0 to T_8 treatments except T_1 (detopping with 3 leaves at 5 days after silking). T_1 showed the lowest canopy temperature (19.43°C) (Table 01). However, the temperature of open field was much higher (31.5 °C).

Length of cob (cm)

Length of cob was not found to be significantly varied with different detopping treatments. The highest cob length was 17.27 cm found for T_5 (detopping with 4 leaves at 10 days after silking) compared to lowest cob length of 15.45 cm for T_3 (detopping with 5 leaves at 5 days after silking) (Table 02). Removing leaves at different times during maize growth, specifically at 12 and 16 weeks after planting, did not have a significant impact on the length of the cob according to a study by Fasae et al. (2009). But Rathika et al. (2008), Barimavandi et al. (2010), Heidari (2012), Jalilian and Delkhoshi (2014), Emran et al. (2014) found a link between cob length and leaf removal.

Girth of the cob (cm)

The study found that neither the timing nor the extent of leaf removal significantly impacted the cob's circumference. The girth of cob was maximum of 15.60 cm for T_4 (detopping with 3 leaves at 10 days after silking) and was minimum of 14.39 cm for T_7 (detopping with 3 leaves at 15 days after silking) (Table 02). These results did not agree with the findings of Rathika et al. (2008) who found topping beyond 10th internode favorably influenced cob diameter of baby corn as well as the finding of Emran et al. (2014).

Grain number row^{-1}

The study showed no connection between how and when leaves were removed and the number of grains that developed on each row of the cob. Maximum average number of kernels on each cob row was found in T_5 (39.13) i.e. detopping with 4 leaves at 10 days after silking while minimum kernel count per row was found in T_3 (33.33) i.e. detopping with 5 leaves at 5 days after silking (Table 02).

These results are in contrast with the findings of previous studies by Emam and Taddayon (1999), Jalilian and Delkhoshi (2014), Barimavandi et al. (2010) and Kabiri (1996) who reported decreased number of grains per row resulting from removal of leaves above the ear. Emam and Taddayon (1999) found maximum grains per row with only three leaves above the cob. In a study by Woldeamlak et al. (2006) on detopping of maize, numbers of grains per row were decreased in case of early detopping (15 days after silking) versus later detopping (30 days after silking). Jalilian and Delkhoshi (2014) noticed that maize plants without leaf clipping gave highest number of grains row^{-1} and lowest number of grains row^{-1} (33.90) with above cob leaf clipping.

Number of grain rows cob^{-1}

This study found that detopping, regardless of timing and length did not significantly impact the number of rows on which kernels developed. Although statistically similar the number of grain rows varied between 15.47 to 14.67 per cob (Table 02). These findings were like those of Emam and Taddayon (1999) and Srisailam (2010). However, these results were in contrast with findings of Jalilian and Delkhoshi (2014) who noted that row number cob^{-1} was influenced by removing leaves above the ear. But, the character remained largely unaffected by the removal of other leaves (Barimavandi et al., 2010).

Grain number cob^{-1}

Total grains per cob did not show any significant relationship with the detopping operation. T_4 (detopping with 3 leaves at 10 days after silking) gave maximum grains per cob of 597.09 compared to T_3 (detopping with 5 leaves at 5 days after silking) which gave 502.24 grains per cob (Table 02). In a study by Roy and Biswas (1992), removing the top of the plant just above the cob resulted in the fewest grains per cob. Similarly, Kabiri (1996) reported that leaf removal at 50% silking decreased grain number per cob. Complete defoliation led to a dramatic decrease of 75% in the number of grains produced per cob (Barimavandi et al., 2010). So, the results contradict the findings. In a study, Emam et al. (2013a) found that maximum grain cob^{-1} (625) was found in the control. In contrast, the minimum number of grains (220) was obtained with 100% defoliation. Emran et al. (2014) reported that lowest grain cob^{-1} (195.6) following complete defoliation of leaf blades.

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Table 01. Effect of different times and levels of detopping on first cob height, number of leaves, leaf area plant^{-1}, SPAD reading of cob bearing leaf, light intensity in experimental plot and canopy temperature

Treatments	First cob height (cm)		Number of leaves		Leaf area plant^{-1} at 20 DAS (cm^2)	SPAD reading of cob bearing leaf		Light intensity in experimental plot (lux)		Canopy temperature (°C)
	20 DAS	30 DAS	20 DAS	30 DAS		20 DAS	30 DAS	20 DAS	30 DAS	
T_0	115.9 a	115.6 a	10.13 a	10.07 a	6478.76 a	54.73 a	51.97 a	4616 b	4420 a	21.3 a
T_1	120.1 a	119.1 a	7.60 b	7.60 b	5299.96 ab	55.83 a	50.37 a	5883 ab	5052 a	19.4 b
T_2	123.1 a	122.8 a	6.93 b	7.07 b	4718.12 ab	56.33 a	56.90 a	5038 ab	4367 a	21.5 a
T_3	118.8 a	118.8 a	5.73 b	5.67 b	3902.08 b	54.40 a	55.50 a	6861 ab	4890 a	21.4 a
T_4	121.7 a	122.4 a	7.80 b	7.53 b	5459.38 ab	59.33 a	55.03 a	5493 ab	4451 a	21.3 a
T_5	117.6 a	117.0 a	7.13 b	7.00 b	4948.99 ab	56.30 a	53.90 a	5378 ab	4437 a	20.9 ab
T_6	122.5 a	122.1 a	5.67 b	5.73 b	3892.23 b	50.87 a	51.73 a	7212 a	5678 a	21.1 a
T_7	119.2 a	119.1 a	7.53 b	7.60 b	4979.38 ab	51.37 a	50.43 a	5675 ab	5010 a	21.0 a
T_8	119.0 a	118.3 a	6.93 b	6.80 b	5098.27 ab	53.73 a	55.63 a	7111 a	4394 a	21.1 a
T_9	118.7 a	118.8 a	5.73 b	5.60 b	3862.49 b	54.77 a	53.80 a	6531 b	4887 a	22.4 a
Level of sig.	NS	NS	**	**	**	NS	NS	NS	NS	NS
CV (%)	4.73	4.58	11.18	11.13	15.24	11.61	12.45	22.78	17.96	4.26

DAS = Days after silking, NS = Non-significant, ** = significant at 1% level of significance

Table 02. Effect of different times and level of detopping on yield contributing characters

Treatments	Length of cob (cm)	Girth of cob (cm)	Grain number row^{-1}	Grain rows cob^{-1}	Grain number cob^{-1}	Weight of 100 grains (g)	Grain weight cob^{-1} (g cob^{-1})	Single cob weight (g)	Stover yield (g plant^{-1})	Grain yield m^{-2} (kg m^{-2})	Green fodder yield (kg m^{-2})
T_0	16.20 ab	15.42 ab	37.07 ab	15.07 a	558.24 ab	28.63 ab	145.49 a	214.53 ab	232.93 a	1.2200 ab	0.000 d
T_1	16.70 ab	15.51 ab	37.20 ab	14.87 a	552.91 ab	28.60 ab	130.00 a	223.20 ab	281.87 a	1.2367 ab	0.343 c
T_2	16.20 ab	15.56 a	34.73 ab	14.93 a	519.63 b	30.13 a	140.01 a	211.73 ab	260.13 a	1.2000 ab	0.542 b
T_3	15.45 b	15.24 ab	33.33 b	15.07 a	502.24 b	28.27 ab	123.58 a	183.73 b	228.67 a	1.0233 b	0.783 a
T_4	17.26 a	15.60 a	38.67 a	15.47 a	597.09 a	28.90 ab	136.96 a	231.73 a	263.73 a	1.3400 a	0.348 c
T_5	17.27 a	15.33 ab	39.13 a	14.67 a	574.05 ab	29.07 ab	143.12 a	228.40 a	257.07 a	1.2900 a	0.567 b
T_6	16.40 ab	15.04 ab	37.07 ab	14.93 a	552.48 ab	28.13 ab	127.13 a	200.00 ab	232.27 a	1.1667 ab	0.779 a
T_7	16.40 ab	14.93 b	36.53 ab	15.07 a	551.09 ab	27.83 ab	138.49 a	203.20 ab	230.00 a	1.1600 ab	0.333 c
T_8	17.10 a	15.35 ab	37.00 ab	15.20 a	562.19 ab	27.67 b	139.73 a	219.20 ab	274.13 a	1.2167 ab	0.542 b
T_9	16.40 ab	15.20 ab	35.93 ab	14.67 a	527.28 ab	27.73 ab	129.20 a	201.47 ab	229.87 a	1.1300 ab	0.753 a
Level of sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**
CV (%)	5.21	2.37	7.13	3.58	7.71	5.01	11.03	10.94	10.59	11.85	9.48

DAS = Days after silking, NS = Non-significant, ** = significant at 1% level of significance

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Weight of hundred grains (g)

Hundred grain weights obtained from plots with different detopping treatments were not significantly varied. Data shows that maximum hundred grain weight was found 30.13 g in T_2 (detopping with 4 leaves at 5 days after silking) and the lowest was found 27.67 g in T_8 (detopping with 4 leaves at 15 days after silking) (Table 02). These findings align with Emam et al. (2013b) who observed no significant difference in 100-grain weight (reaching 22 grams) between control plants and those with 50% leaf removal, at 30 days after mid-silking. Jalilian and Delkhoshi (2014) reported that removing leaves (leaf clipping treatments) significantly impacted the weight of 1000 seeds. Plants that weren't defoliated (no leaf clipping) produced the heaviest kernels, averaging 274 grams per 1000 seeds. Ear leaf clipping and below-ear leaf clipping resulted in slightly lighter kernels, but still ranked higher in weight. Regardless of the growth stage, removing leaves altogether (defoliation) led to a decrease in both the weight of 1000 kernels and the overall grain yield.

Grain weight cob^{-1} (g cob^{-1})

Grain weight cob^{-1} was recorded at different levels and time of detopping was not significantly varied. According to the data obtained, the highest per cob grain weight was 145.49 g in T_0 (no detopping) and the lowest per cob grain weight was 123.58 g in T_3 (detopping with 5 leaves at 5 days after silking) (Table 02). Chaudhary and colleagues (2005) found that in maize, removing leaves led to the greatest seed weight per cob, with the lowest seed weight per cob occurring when all leaves beneath the cob were removed two weeks after mid-silking. Maposse and Nhampalele (2009) observed that defoliation treatment decreased per cob seed weight. Reduced grain weight per cob may be attributed to decreased assimilate translocation to grains, resulting in lower dry matter accumulation due to early detopping effects. During the grain filling stage at physiological maturity, the capacity of the source can also affect grain weight (Andrade et al., 2005). Emam and colleagues (2013a) also documented comparable results. However, these outcomes align with the conclusions of Woldeamlak and co-researchers (2006), who observed no significant differences in mean grain weight attributable to the timing of detopping. At early grain development stages, mean grain weight is affected by assimilate availability. Therefore, during later stages of grain filling, an augmented availability of assimilates would not increase mean grain weight (Lauer et al., 2004).

Single cob weight (g)

No significant influence of detopping on single cob weight of maize was observed. The highest single cob weight was 231.73 g found in T_4 (detopping with 3 leaves at 10 days after silking) compared with the lowest single cob weight of 183.73 g found in T_3 (detopping with 5 leaves at 5 days after silking) (Table 02). These results do not align with Gaurkar and Bharad (1998), who mentioned cob weight increased by detopping one leaf above the cob. But Heidari (2012) mentioned cob weight declined with defoliation.

Stover yield (g plant^{-1})

Stover yield from leftover maize plants did not significantly differ with detopping operations. Stover yield per plant was highest at 281.87 g in T_1 (detopping with 3 leaves at 5 days after silking) and the lowest stover yield was 228.67 g per plant in T_3 (detopping with 5 leaves at 5 days after silking) (Table 02). Similarly, Hassen and Chauhan (2003) reported that removing up to 50% of maize leaves did not notably impact stover yield. However, Wilhelm et al. (1995) found that stover yield decreased when more leaves were removed.

Grain yield m^{-2} (kg m^{-2})

No significant variations in grain yield per unit of land area were observed across different stages and heights of detopping. So, different detopping operations were statistically similar for grain yield per square meter. The highest grain yield per unit area was obtained 1.34 kg from T_4 (detopping with 3 leaves at 10 days after silking) and the lowest grain yield was 1.0233 kgm^{-2} from T_3 (detopping with 5 leaves at 5 days after silking) (Table 02). These results are similar to those of Sarvestani et al. (2001), Barimavandi et al. (2010) and Emam et al. (2013a), who had maximum grain yield in control, but no significant yield reduction was obtained due to detopping.

Green fodder yield (kg m^{-2})

Green fodder yield was significantly varied with detopping treatments. The highest fodder yield 0.783 kg m^{-2} was obtained with T_3 (detopping with 5 leaves at 5 days after silking) (Table 02). This result was confirmed by Mimbar and Susylowati (1995) and Rathika (2014) who mentioned that green

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fodder yield varied significantly with detopping practices. Accordingly, Roy and Biswas (1992) discovered that fodder yield rose as plant density increased, particularly when plants were detopped slightly above the cob. Similarly, Emam and Taddayon (1999) mentioned that higher fodder resulted from detopping, which had the highest plant density and kept only one leaf above the ear.

IV. Conclusion

Based on these findings, it can be concluded that detopping maize plants at different heights and timings did not significantly reduce yield, suggesting that detopping up to 5 leaves above the cob and up to 15 days after silking is feasible. Detopping at 5 days after silking with 5 leaves is recommended for optimal fodder yield. Further research could explore the possibility of detopping more leaves without significantly affecting grain yield.

V. References

[1]. Adhikari, K. (1990). Response of maize to different planting densities, foliage removal practices and thinning times. Journal of the Institute of Agriculture and Animal Science, 11, 105-112.

[2]. Allison, J. C. S. and Watson, D. J. (1966). The production and distribution of dry matter in maize after flowering. Annals of Botany, 30, 365-381. https://doi.org/10.1093/oxfordjournals.aob.a084082

[3]. Andrade, F. H., Sadras, V. O., Vega, C. R. C. and Echarte, L. (2005). Physiological determinants of crop growth and yield in maize, sunflower and soybean: their application to crop management, modeling and breeding. Journal of Crop Improvement, 13, 52-101. https://doi.org/10.1300/J411v14n01_05

[4]. Barimavandi, A. R., Sedaghathoor, S. and Ansari, R. (2010). Effects of different defoliation treatments on yield and yield components in maize (*Zea mays* L.) cultivar of SC704. Australian Journal of Crop Science, 4(1), 9-1.

[5]. Bijanzadeh, E. and Emam, Y. (2010). Effect of defoliation and drought stress on yield components and chlorophyll content of wheat. Pakistan Journal of Biological Sciences, 13(14), 699-705. https://doi.org/10.3923/pjbs.2010.699.705

[6]. Chaudhary, A. N., Latif, M. I., Haroon Ur-Rasheed, M. and Jilani, G. (2005). Profitability increase in maize production through fertilizer management and defoliation under rain fed cropping. International Journal of Biology and Biotechnology, 2(4), 1007-1012.

[7]. Dowswell, C. R., Paliwal, R. L. and Cantrell, R. P. (1996). The Maize Plant and its Uses. Haper Collins Publishers. p. 27.

[8]. Emam, Y. and Taddayon, M. R. (1999). Effects of plant density and detopping on grain yield and yield components of maize at Doroodzan area of Fars Province [Persian]. Iranian Journal of Agricultural Sciences, 30(4), 743-750.

[9]. Emam, Y., Bahrani, H. and Maghsoudi, K. (2013a). Effect of leaf defoliation on assimilate partitioning in maize (*Zea mays* L.). Scientific Journal of Agronomy and Plant Breeding, 1(1), 26-33.

[10]. Emam, Y., Sedaghat, M. and Bahrani, H. (2013b). Response of maize (SC704) yield and yield components to source restriction. Iran Agricultural Research, 32(1), 3139.

[11]. Emran, S. A., Haque, K. M. S., Khaliq, Q. A. and Miah, M. Y. (2014). Source-sink manipulation and population density effects on fodder and grain yield of hybrid maize. Bangladesh Agronomy Journal, 17(1), 59-66. https://doi.org/10.3329/baj.v17i1.23677

[12]. Esechie, H. A. and Al-Alawi, K. (2002). Effect of tassel removal on grain yield of maize (*Zea mays* L.) under saline conditions. Crop Research, 24, 96-101.

[13]. Fasae, O. A., Adu, F. I., Ania, A. B. J. and Elemo, K. A. (2009). Effects of defoliation time of maize on leafy yield, quality and storage of maize leaf as dry season forage for ruminant production. Revista Brasileira de Ciências Agrárias, 4(3), 353-357. https://doi.org/10.5039/agraria.v4i3a19

[14]. FRG (2012). Fertilizer Recommendation Guide, Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka 1215. P, 90.

[15]. Gardner, P. F., Pearce, R. B. and Mitchell, R. L. (1985). Physiology of Crop Plants Iowa State University Press. Ames. USA. pp. 31-32.

Published with open access at journalbinet.com
EISSN: 2312-7945, © 2024 The Authors, Research paper

[16]. Gaurkar, S. G and Bharad, G. M. (1998). Effect of plant population, detopping and nitrogen levels on growth and yield of maize (*Zea mays* L.). PKV Research Journal, 22(1), 136-137.
[17]. Hassen, H. and Chauhan, S. S. (2003). Effect of rate of maize leaf defoliation at various growth stages on grain, stover yield components of maize and under sown forage production. Indian Journal of Agricultural Research, 37(2), 136-139.
[18]. Heidari, H. (2012). Effect of defoliation intensity on maize yield, yield components and seed germination. Life Science Journal, 9(4), 1594-1598.
[19]. Hicks, D. R., Nelson, W. W. and Ford, J. H. (1977). Defoliation effects on corn hybrids adapted to the Northern Corn Belt. Agronomy Journal, 69, 387-390. https://doi.org/10.2134/agronj1977.00021962006900030014x
[20]. Islam, T. M. T. and Kaul, A. K. (1986). Prospects of maize in Bangladesh. FAO/UNDP. Dhaka, Bangladesh. pp. 105-109.
[21]. Jalilian, J. and Delkhoshi, H. (2014). How much, leaves near the ear contribute on yield and yield components of maize. Crcetări Agronomiceîn Moldova, 2(158), 5-12. https://doi.org/10.2478/cerce-2014-0012
[22]. Kabiri, M. (1996). Study on effect of source: sink change and the role of unstable stem reserve on yield of two sweet corn cultivers. M.Sc. Thesis. Department of Agriculture, Karaj, Iran.
[23]. Kaul, A. K. and Rahman, M. M. (1983). Crop diversification for intensive cropping. Paper presented at First Workshop on National Cropping System Research. BARI, Joydebpur, Gazipur. 10-13, p.16.
[24]. Keating, B. A. and Carberry, P. S. (1993). Resources capture and use in intercropping; solar radiation. Field Crop Research, 34, 273-301. https://doi.org/10.1016/0378-4290(93)90118-7
[25]. Khaliliaqdam, N., Soltani, A., Mir-Mahmoodi, T. and Tooraj, J. (2012). Effect of leaf defoliation on some agronomical traits of corn. World Applied Sciences Journal, 20(4), 545-548.
[26]. Lauer, G. J., Roth, G. W. and Bertram, M. G. (2004). Impact of defoliation on corn forage yield. Agronomy Journal, 96, 1459-1463. https://doi.org/10.2134/agronj2004.1459
[27]. Maposse, I. C. and Nhampalele, V. V. (2009). Performance of cowpea varieties under different defoliation regimes for multiple uses. In: African Crop Science Conference Proceedings, 9, 279-281.
[28]. Mimbar, S. M. and Susylowati (1995). The effect of time and position of topping of maize on yield of the maize-groundnuts cropping system (Indonesian). Agrivita, 18(1), 21-25.
[29]. Pearce, R. B., Brown, R. H. and Blaser, B. E. (1965). Relationship between leaf area index, light interception and net photosynthesis in orchard grass. Agril. Meterorol. 5, 553-556. https://doi.org/10.2135/cropsci1965.0011183X000500060021x
[30]. Quasem, M. A. (1999). FMRSP Working Paper No. 14, FMRSP Bangladesh, Food Management & Research Support Project, Ministry of Food, Government of the People's Republic of Bangladesh, International Food Policy Research Institute.
[31]. Rathika, S. (2014). Influence of crop geometry, intercropping and topping practices on green cob yield and fodder quality of baby corn (*Zea mays* L.). International Journal of Agricultural Sciences, 10(1), 182-185.
[32]. Rathika, S., Velayudham, K., Muthukrishnan and Thavaprakaash, N. (2008). Effect of crop geometry and topping practices on the productivity of baby corn (*Zea mays* L.) based intercropping systems. Madras Agriculture Journal, 95(7-12), 380-385.
[33]. Roy, S. K and Biswas, P. K. (1992). Effect of plant density and detopping following silking on cob growth, fodder and grain yield of maize (*Zea mays*). Journal of Agricultural Science, 119(3), 297-300. https://doi.org/10.1017/S0021859600012156
[34]. Sarvestani, Z. T., Omidy, H. and Chokan, R. (2001). Effects of plant density and source limitation on yield, yield components and dry matter and nitrogen remobilization in corn. [Persian]. Seed and Plant, 17(3), 294-314.
[35]. Srisailam, G. (2010). Effect of detopping on dry matter production and grain yield in maize (*Zea mays* L.) during rabi. M.Sc., (Ag.), Thesis, Acharya N.G. Ranga Agricultural University, Andra Pradesh.
[36]. Usman, K., Khan, E. J., Khan, Q., Wakil, A. and Khan, M. U. (2007). Effect of detopping on forage and grain yield of rice under agro-climatic conditions of D.I. Khan. Sarhad Journal of Agriculture, 23(1), 1-4.

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EISSN: 2312-7945, ©2024 The Authors, Research paper

[37]. Wilhelm, W. W., Johnson, B. E. and Schepers, J. S. (1995). Yield, quality and nitrogen use of inbred corn with varying numbers of leaves removed during detasseling. Crop Science, 35, 209-212. https://doi.org/10.2135/cropsci1995.0011183X003500010039x

[38]. Woldeamlak, S., Zelleke, H. and Pal, U. R. (2006). Effect of time and level of detopping on grain and fodder yield and quality of maize (*Zea mays* L.) tops in Eastern Hararghe. http://agris.fao.org/aos/records/ET2007000296.

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Harvard

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Vancouver

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