EFFECT OF DETASSELING AND DEFOLIATION IN THE YIELD OF SWEETCORN IN KHOTANG DISTRICT OF NEPAL

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ABSTRACT

As maize is a C4 plant it is expected to have greater productivity however, its production and productivity are not found to its potential. Therefore, to evaluate the effect of detasseling and defoliation to increase the productivity, a field experiment was conducted on sweetcorn at Khotang, Nepal in 2021. The study was executed in Randomized Complete Block Design (RCBD) with three replications and seven treatments. The results revealed that number of kernels (608.46), number of rows (15.20), 1000 grains weight (210.68gm) were recorded significantly higher in the plot where 50% plants were detasselled. It clearly shows that 50% detasseling is one of the best options to enhance the yield of sweetcorn followed by detasseling + defoliation of all leaves leaving three leaves below the ear.

Keywords: Defoliation, detasseling, productivity, sweetcorn

INTRODUCTION

Maize is the second most important cereal crop of Nepal after rice which can be used as food, feed, fodder (Karki *et al.*, 2015). Maize (Zea mays L.) is a versatile crop with a higher adaptability range under diverse agro-climatic conditions and has the highest yield potential among the cereals (Yadav *et al.*, 2015). The area and production of maize in Nepal is 9,79,776 ha and 29,99,733 mt with the productivity of 3.06 in 2077/78. Nepal imports most of its Sweet corn frozen from India. Nepal is the largest importer of Sweet corn frozen and accounts 287 ton in the year 2020/21 (Volza grow global, 2020/21). The imports of sweet corn from India is increasing year by year due to changed food habit and tourism industry. So, the study regarding sweet corn would provide the policy feedback for future.

There are various types of maize each having distinctive characteristics and uses. Among all, sweetcorn is also the one which is prominent in worldwide context however it is barely cultivated and consumed in our country. It has a sugary rather than starchy endosperm and a creamy texture. The low starch level makes the kernel wrinkled rather than plumpy (Lahay *et al.*, 2019).

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Tassel represents the male flower whereas silk is the female. It is estimated that normal tassel of maize produces 2,50,00,000.00 pollen grains (Smith *et al.*, 2004), and utilize a huge amount of energy/nutrients. All the pollen grains produced by the plants will not be utilized for pollination. The nutrients used in producing pollens that are destined to be wasted can be diverted towards the sink of the plant by removing some tassels before pollen shed for better grain yield through accumulating the higher biomass and improved translocation of the accumulated biomass towards the sink (Jakhar *et al.*, 2017). Removal of 50% tassels at 3 DAE is highly effective in harnessing higher grain yield (Sammauria *et al.*, 2019).

Maize tassel removal helps light penetration in the canopy of maize plants that fulfils a high light requirement of the C4 plant like maize. Tassel removal increases both the seed yield and the seed quality of maize. Interaction of defoliation and tassel removal may also affect assimilate distribution between reproductive and vegetative organs (Heidari, 2013). Leaf removal and detasseling are important practices as they enable maize plants to maximize the allocation of total dry matter (TDM) to economic yield. Removal of the lower leaves at the anthesis-silking stage can potentially increase the maize yield since it reduces the apical dominance, increases photo synthetically active radiation intercepted, reducing resources competition and water loss by transpiration (Murindangabo *et al.*, 2019).

Increasing the yield per plant is the main motive of technical maize farming. Different cultural practices can be imposed or modified to increase the yields such as use of improved hybrid varieties, irrigation, and higher plant populations which are very hard task along with being too costly. Due to various lagging khotang district is not being able to progress in successive maize farming. The current production status of maize in Nepal is not able to sustain the consumption demand of people living in the country (Karki *et al.*, 2015). Still, here is dependency of traditional farming system, farmers are not aware about the potential benefits from the practice of detasseling and defoliation on maize farming. This system maximizes the intensity of the cob development by transferring the stored energy to cob development in growing period. Moreover, due to more demand of sweetcorn in the star hotels of Nepal, it is in higher demand range, which could give more return than any other varieties.

MATERIALS AND METHODS

EXPERIMENTAL SITE

The field experiment was conducted at Diktel Rupakot Majhuwagadhi Municipality of Khotang district, province-1 from February to July 2021. The research site is located at coordinates of 27.2193° N, 86.7919° E, and an altitude of 1540m. The soli texture was sandy loam to sandy clay. The daily maximum and minimum temperature varied from 15°C to 25°C and 17°C to 22°C, respectively during the cropping period.

EXPERIMENTAL DESIGN

The Randomized Complete Block Design (RCBD) was followed with three replications and a total of seven treatments. The unit plot size was 2*2.5 m^2, space between each plot was 50cm. The crop was planted with the spacing of row to row 60cm and plant to plant 20cm. There were 4 rows and a total of 40 plants in each plot. FYM was incorporated in the research field at the rate of 15t/ha two weeks before sowing. Similarly, chemical fertilizers were applied as per the recommendation i.e. 120:60:40 kg/ha of NPK, respectively. Half of the urea and full dose of other chemical fertilizers were applied as a basal. The remaining 50% of the total dose of the nitrogen was splitted into two halves and top-dressed during the knee-high stage and earthing up. Other intercultural operations such as weeding, irrigation, pest control measures were followed and performed uniformly in all the treatments.

Table 1. Treatment details

Treatment symbol	Treatment details
T_1	Control
T_2	Detasseling only
T_3	Detasseling + defoliation of 2 upper leaves
T_4	Detasseling + defoliation of 3 upper leaves
T_5	Detasseling + defoliation of all leaves below the third leaf below the ear
T_6	Detasseling + defoliation of 2 upper leaves and all leaves below the third leaf below the ear
T_7	Detasseling + defoliation of 3 upper leaves and all leaves below the third leaf below the ear

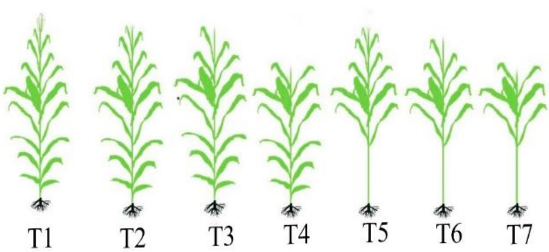

Figure 1. Detail of treatments

Detasseling was performed after 3 days of the emergence of the tassel on 50% per plot with respective treatments (Sammauria *et al.*, 2019). Defoliation was done after 3 days of the emergence of silk (Sammauria *et al.*, 2019). Pollen shed usually lasts for 5 to 8 days with peak shed by the 3rd day.

PARAMETERS RECORDED

Data collection and analysis

Vegetative, floral and metrical data measurements were taken from each plot, 5 sample plants were selected randomly and data were recorded. Floral measurements included days to 50% tasselling and days to 50% silking (Maydis formation) to calculate the effective days for tassel removal and ear development. Number of kernel rows per ear, total number of kernels per ear, fresh weight of ear (gm), weight of ear after removing cover(gm), weight of ear before removing cover(gm), weight of grain (gm), ear length (cm), ear girth (cm), cob weight (gm) were measured under the metrical measurements.

Whereas, weight of grain (gm) is concerned; sweetcorn is harvested in the immature milking stage when detachment of grain for weighing is difficult so, grain weight is calculated by subtracting the cob weight from the weight of the ear after DE husking.

The data were analyzed using Duncan's Multiple Range Test (DMRT) at 5% level of significance for the separation of means using the package agricolae. The collected data were entered into MS-excel version 2016 (compatibility mode) and were analyzed using R studio version 3.5.3.

RESULTS AND DISCUSSIONS

EFFECT ON DEVELOPMENT OF NUMBER OF KERNELS

Analysis of variance revealed that the number of kernels is significantly ($p<0.05$) influenced (Table 2) by detasselling and defoliation. The highest number of Kernels was recorded on T2, detasseling performed (608.46) which was significantly ($p<0.05$) higher than other treatments. The lowest number of kernels was recorded for T_7, detasseling plus defoliation of three upper leaves and all leaves below the third leaf below the ear (416.40) which is statistically similar to T_6, detasseling plus defoliation of two upper leaves, and all leaves below the third leaf below the ear (417.73), T_4, detasseling plus defoliation of three upper leaves (465.40) and T_1, control (448.68) respectively.

EFFECT ON NUMBER OF KERNEL ROWS

Analysis of variance showed that the number of kernel rows is significantly ($p<0.05$) influenced (Table 2). The highest number of kernel rows was recorded on T_2, detasseling (15.20) which was significantly ($p<0.05$) higher than any other treatments. The Lowest number of kernel rows was recorded at T_7, detasseling plus defoliation of three upper leaves and all leaves below the third leaf below the ear (13.60).

EFFECT ON WEIGHT OF GRAIN

Analysis of variance indicated that the weight of kernels was significantly ($p<0.05$) influenced (Table 2). The highest weight of the grain was recorded at T_2, detasseling (210.68 gm) which was significantly ($p<0.05$) higher than other treatments but statistically similar with treatment T_5, detasseling plus defoliation of all leaves below the third leaf below the ear (176.94 gm). The lowest weight of kernel was recorded for T_7, detasseling plus defoliation of three upper leaves and all leaves below the third leaf below the ear (125.85 gm) which was statistically similar with T_6, T_4, T_3, and T_1.

EAR WEIGHT BEFORE AND AFTER DEHUSKING

The analyzed data revealed that the weight of the ear after DE husking was significantly influenced and the weight of the ear before DE husking is not significantly ($p<0.05$) influenced.

Before dehusking, the highest weight of the ear was recorded on treatment T_2, detasseling (395.67 gm) and lowest weight of the ear was recorded on treatment T_7, detasseling + defoliation of three upper leaves and all leaves below the third leaf below the ear (289.66 gm).

After dehusking, the highest weight of the ear was recorded on treatment T_2, detasseling (275.00 gm) which differed significantly ($p<0.05$) from other treatments but was statistically similar with treatment T_5, detasseling + defoliation of all leaves below the third leaf below the ear (233.33 gm). The lowest weight of the ear was recorded on the treatment T_7, detasseling + defoliation of three upper leaves and all leaves below the third leaf below the ear (182. 67 gm) which is statistically at par with treatment T_1, T_3, T_4, and $T_{6,}$ respectively (Table 2).

Table 2. Effect of detasseling and defoliation on the yield attributing traits of sweetcorn

Treatment	Number of kernels	Number of rows	1000 grain weight (gm)	Ear weight before dehusking (gm)	Ear weight after dehusking (gm)
1	448.867[cd]	13.733[b]	134.652[bc]	302.333[b]	194.667[a]
2	608.467[a]	15.200[a]	210.679[a]	395.667[a]	275.000[bc]
3	488.400[bc]	13.733[b]	162.394[bc]	331.667[ab]	219.000[bc]
4	465.400[bcd]	13.867 [b]	166.128[bc]	327.333[b]	219.667[bc]
5	517.267[b]	14.000 [b]	176.939[ab]	357.333[ab]	233.333[ab]
6	471.733[bcd]	13.733 [b]	153.009[bc]	306.333[b]	209.667[bc]
7	416.400[d]	13.600 [b]	125.854[c]	289.667[b]	182.667[c]
LSD (0.05)	60.05255	0.4252501	38.98472	68.04504	41.83623
S. Em(±)	7.37	0.05	4.78	8.35	5.13
F-probability	<0.001	<0.001	<0.01	ns	<0.01
CV (%)	6.916232	1.709753	13.57914	11.58899	10.73127
Grand Mean	488.0762	13.98095	161.3793	330.0476	219.1429

Note: The common letter(s) within the column indicate non-significant difference based on the Duncan multiple range tests (DMRT) at a 0.05 level of significance, ** significant at 1% level of significance, *** significant at 0.1% level of significance. (SEm – Standard Error of mean, CV – Coefficient of Variation, LSD – Least Significance Difference)

EFFECT ON EAR GIRTH DEVELOPMENT

Analysis of variance proved that ear girth is not significantly ($p<0.05$) influenced (Table 3) by the operations carried out.

EFFECT ON EAR LENGTH

Analysis of variance revealed that the ear length is not significantly ($p<0.05$) influenced (Table 3).

EFFECT ON COB WEIGHT DEVELOPMENT

Analysis of variance revealed that cob weight (Table 3) was significantly ($p<0.05$) influenced. The highest cob weight was recorded for treatment T_2, detasseling (64.32 gm) which was significantly higher than other treatments but statistically similar with treatment T_1, Control (60.01 gm). The lowest cob weight was recorded for treatment T_4, detasseling + defoliation of three upper leaves (53.54 gm) which was statistically similar (at par) with T_3, T_5, T_6, and T_7.

EFFECT ON COB GIRTH DEVELOPMENT

Analysis of variance revealed that cob girth (Table 3) is not significantly ($p<0.05$) influenced.

EFFECT ON COB LENGTH

Analysis of variance revealed that cob length is not significantly ($p<0.05$) influenced (Table 3).

Table 3. Effect of detasseling and defoliation on the yield attributing characteristics of sweetcorn

Treatments	Ear length (cm)	Ear girth (cm)	Cob weight (gm)	Cob girth (cm)	Cob length (cm)
T1	14.58	13.95	60.01^{ab}	8.71	17.00
T2	16.57	15.66	64.32^{a}	9.85	17.93
T3	15.63	14.83	56.61^{bc}	9.49	17.75
T4	15.12	15.12	53.54^{c}	9.65	17.88
T5	16.05	14.98	56.39^{bc}	9.28	18.25
T6	14.85	14.71	56.66^{bc}	8.87	17.13
T7	13.95	14.12	56.81^{bc}	8.66	16.72
LSD (0.05)	2.19	1.09	4.79**	0.94	1.73
S. Em (±)	0.27	0.13	0.59	0.12	0.21
F-probability	ns	ns	<0.01	ns	ns
CV (%)	8.07	4.16	4.66	5.72	5.56
Grand Mean	15.25	14.77	57.76	9.22	17.52

Note: The common letter(s) within the column indicate non-significant difference based on Duncan Multiple Range Test (DMRT) at 0.05 level of significance, ** significant at 1% level of significance, *** significant at 0.1% level of significance. (SEm – Standard Error of mean, CV – Coefficient of Variation, LSD – Least Significance Difference.

COST BENEFIT ANALYSIS

Though detasseling is labour intensive, the b/c ratio would not be decreased but increased due to change in productivity. The b/c ratio of maize farming was found 1.4 in the case of improved irrigated condition (MRSMP, 2017/18). In case of detasseling, the labour cost would increase by just 2-3% in the section of labour. The productivity of detasseled maize would increase by 15% in total. So, the practice of detasseling is important and economically beneficial.

CONCLUSIONS

As the yield parameters like the number of kernels, the number of kernel rows per ear, weight of grains was found significantly higher in T_2 (50% detasseling) compared to other remaining treatments; detasseling can be recommended to increase the grain yield of the sweetcorn. Similarly, detasseling + defoliation of all leaves below the third leaf below the ear showed remarkable results after the detasseling only, with a second higher grain yield. On the contrary, Detasseling + defoliation of three upper leaves and all leaves below the third leaf below the ear appeared to have lower grain yield followed by control. Hence, we can conclude that 50% detasseling is the best way to enhance the grain yield of the sweetcorn.

REFERENCES

Heidari, H., 2013. Yield, Yield Components and Seed Germination of Maize (Zea maysL.) at Different Defoliation and Tassel Removal Treatments. *Philipp agric scientist*, 42–47.

Jakhar, P. Rana, K. Dass, A. Choudhary, A. Choudhary, M. and Maharana, J., 2017. Moisture conservation practices in maize-mustard cropping system: Effects on productivity, water use and soil fertility. Indian Journal of Soil Conservation, 288-295.

KC, G. Karki, T. B. Shrestha, J. and Achhami, B. B., 2015. Status and prospects of maize research in Nepal. Journal of Maize Research and Development.

Lahay, R. R. Sipayung, R. and Sabrina, T., 2019. The growth and yield of sweet corn (*Zea mays saccharata* Sturt.). IOP Conference Series: Earth and Environmental Science.

Murindangabo, Y. Lai, W. Tafadzwa, G. and Sang, C., 2019. Effect of Detasselling and Leaf stripping on Maize Grain filling and Yield. Rwanda Journal of Social & Applied Sciences *(RJSAS)* , 2310-3205.

Sammauria, R. Balyan, J. and Bairwa, P., 2019. Time, intensity of detasseling rainfed maize (*Zea mays*) for improving productivity, economics and rainwater-use efficiency. Indian Journal of Agricultural Sciences, 65-66.

Smith, C. W. Betran, J. and Runge, E. C., 2004. *Corn:* Origin, History, Technology, and Production. Wiley.

Yadav, O. Kumar, B. and Dhillon, B., 2015. Genetic Improvement of Maize in India: Retrospect and Prospects [2015. *AGRIS, FAO].*