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## Effect of de - topping and nitrogen doses on yield and yield characters of two maize (*Zea mays* L.) varieties under Chhattisgarh condition

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### Abstract

The experiment was conducted at research Farm, Indira Gandhi Agriculture=University, Raipur (C.G.) during *Kharif* 2018 to study the effect of de- topping and nitrogen levels on productivity of maize (*Zea mays* L.) with two maize varieties (African tall and hybrid 25K55) practicing de-topping and no de-topping in main plots and four nitrogen levels in sub plot under split plot design and replicated thrice. The results of experiment on response of de-topping and nitrogen levels revealed that the grain yield ( $37.7q\ ha^{-1}$ ), length of cob ( $13.43\ cm$ ), number of grains  $row^{-1}$  ( $24.9$ ), test weight ( $25.9\ g$ ), shelling % ( $83.04$ ) considerably higher under treatments receiving no de-topping and harvest index ( $29.2$ ), cob girth ( $4.9\ cm$ ) was recorded highest when practiced de-topping.

Whereas remarkable lowest values were obtained in de-topped treatments The experiment resulted that, there was significant reduction in grain yield of  $15\ %$  when de-topping in African tall whereas, hybrid 25K55 with de-topping resulted  $9\ %$  reduction in grain yield. Similarly, all these characters were also superior under treatment receiving  $150\ kg\ N\ ha^{-1}$ . The least value was obtained in unfertilized treatment.

**Keywords:** Topping, de- topping, nitrogen levels, productivity

### Introduction

Maize (*Zea mays* L.) popularly known as corn or *makka* is one of the important cereal crops in world agriculture economy both as food for man and feed for animals. Maize is one of the most versatile crop with wide adaptability in agro-ecologies with maximum biomass production ability in short duration. It has highest genetic potential among food grains crops. In india maize is third most important food crop after rice and wheat in addition to staple food for humans and feed for animals. Among non-legumes fodders, maize is good source of starch, neutral detergent fibre ( $38-41\ %$ ), acid detergent fibres ( $23-25\ %$ ), lipid ( $5\ %$  oils), crude-protein ( $8-10\ %$ ) therefore considered as energy efficient crop for livestock.

It is a  $C_4$  plant, having high fodder production ability in short duration of time. Maize is cultivated through the year in different parts of country for various purpose including grain, baby corn fodder, green cobs, pop corn *etc.* In India maize is grown in  $9.5$  million hectare area with production of  $26.63$  million tones. In Chhattisgarh it is cultivated in  $226.79$  hectare area with an average yield of  $2458\ kg\ ha^{-1}$ . Its cultivation is confined to Ambikapur, Jashpur, Bilaspur, Raigarh, Raipur, Durg, Kanker, Jagdalpur and Dantewada districts of Chhattisgarh.

It is an important crop to develop standard agronomic practices to get maximum productivity. De-topping is one such culture operation practiced by maize growers. De-topping is such a cultural practice in which the apical or terminal portion of plant is removed from nodes above cobs *i.e.* leaving one or two leaves with aim to increase yield by controlling lodging, increasing light interception, increasing nutrient uptake, diverting plant nutrient to developing reproductive part (cobs) which in turn improves source to sink efficiency and resulting better cobs development.

Hence, the present study was carried out with an objective to study the effect of de-topping and nitrogen levels on yield of maize (varieties).

### Material and Methods

The experiment was conducted during kharif, 2018 at Instructional cum Research farm, College of Agriculture, Indira Gandhi Krishi Vishwavidyalay, Raipur (C.G.) with proper irrigation and drainage facilities. The institute is situated at Raipur in the central part of Chhattisgarh, climatologically known as "Chhattisgarh Plains" and geographically farm lies in between  $21^{\circ} 16' N$  latitude and  $81^{\circ} 26' E$  longitude at altitude of  $289.56$  meters above the mean sea level (MSL), and falls under central plateau. According to soil analysis, the soil of the experimental site was sandy loam in texture. The soil was neutral in reaction pH ( $7.8$ ) with

electrical conductivity (EC) in the safer range (0.21 dSm<sup>-1</sup>), low in organic carbon (0.58%) and available N (229.5 kg ha<sup>-1</sup>) but medium in available phosphorus (16.3 kg ha<sup>-1</sup>) and medium in potassium (272.02 kg ha<sup>-1</sup>). A uniform dose of P<sub>2</sub>O<sub>5</sub> (50 kg ha<sup>-1</sup>) and K<sub>2</sub>O (40 kg ha<sup>-1</sup>) were applied in the form of diammonium phosphate (DAP) and muriate of potash (MOP), respectively and nitrogen was applied in three splits, 40% at basal, 30% at knee high stage and 30% at tasseling stage was scheduled through urea. The experiment was laid out in split plot design with three replications and comprising sixteen treatment combinations with de-topping & no-detopping in maize varieties in main plots and four nitrogen levels 0, 50 kg, 100 kg, and 150 kg N ha<sup>-1</sup> in sub plots with 2.7 x 3 m net plot area.

## Result and Discussion

### Grain yield

Yielding ability is one of the important quantitative characters in crop and it depends upon the development of crop phenotypic characteristics. The data on grain yield as affected by de-topping and nitrogen levels is presented in Table 1. Grain yield of maize was significantly influenced by de-topping as maximum yield (37.7 q ha<sup>-1</sup>) was recorded in hybrid 25K55 with no de-topping, whereas minimum grain yield (18.28 q ha<sup>-1</sup>) was recorded in African tall with de-topping. Grain yield of fodder variety African tall was less as compare to hybrid variety due to less seed setting and low productivity of fodder maize variety in regards to seed production. Tilahun *et al.*, (1993) [4] also reported results regarding the direct relationship between grain yield and the number of leaves de-topped.

**Table 1:** Yield characters of maize varieties at different stages as influenced by de-topping and nitrogen levels

Treatments	Grain yield (q ha <sup>-1</sup> )	Stover yield (q ha <sup>-1</sup> )	Length of cob (cm)	Cob girth (cm)	Number of Grains row <sup>-1</sup>	Test weight (g)	Shelling percent	Harvest Index
Main plot: DT and No DT								
Fodder type: African tall								
D <sub>1</sub> : No De -topping	21.40	140.4	12.64	3.9	24.3	24.3	71	12.8
D <sub>2</sub> : De-topping	18.28	108.5	11.65	4.1	23.3	23.3	65.7	13.8
Grain type: Hybrid 25K55								
D <sub>3</sub> : No De-topping	37.73	102.3	13.43	4.8	24	25.9	78.5	26.3
D <sub>4</sub> : De-topping	34.13	78.12	12.98	4.9	24.8	24.7	74.3	29.2
S.Em ±	0.5	4	0.15	0.1	0.3	0.5	1.08	0.5
CD(P=0.05)	1.65	13.4	0.53	0.2	1.1	1.7	3.75	1.84
Sub plot: Nitrogen levels N (kg ha <sup>-1</sup> )								
N <sub>1</sub> : 0	14.5	81.8	8.49	3.8	15.3	19.8	62.5	15.9
N <sub>2</sub> : 50	22.5	108.4	10.81	4.4	20.5	24.4	70.1	18.07
N <sub>3</sub> : 100	33.8	113.9	13.79	4.7	26.3	25.7	77.3	23.6
N <sub>4</sub> : 150	40.6	126.2	17.60	4.9	33.7	28.4	80.4	24.7
S.Em ±	0.51	3.9	0.23	0.1	0.8	0.6	1.16	0.76
CD(P=0.05)	1.48	11.6	0.67	0.2	2.4	1.9	3.39	2.2
Interaction DXN	S	NS	S	S	NS	NS	S	NS

**Table 2:** Grain yield (q ha<sup>-1</sup>) of maize varieties as influenced by interaction effect of de-topping and nitrogen levels

Main plot: DT and No DT	Sub plot				Mean	
	N <sub>1</sub> : 0	N <sub>2</sub> : 50	N <sub>3</sub> : 100	N <sub>4</sub> : 150		
Fodder type: African tall						
D <sub>1</sub> : No De -topping	11.8	16.4	25.2	32.1	21.4	
D <sub>2</sub> : De-topping	9.2	13.3	21.9	28.5	18.2	
Grain type: Hybrid 25K55						
D <sub>3</sub> : No De-topping	20.1	32.1	46	52.6	37.7	
D <sub>4</sub> : De-topping	17.1	28.1	42.1	49.1	34.1	
Mean	14.5	22.5	33.8	40.6		
<b>Interaction</b>					<b>S.Em ±</b>	<b>CD (P=0.05)</b>
Comparison of two topping means at the same levels of nitrogen levels					1.02	2.9
Comparison of two nitrogen levels means at the same levels of topping					1.38	4.5

The interaction effect of de-topping and nitrogen levels was found significant. When plants are de-topped above the cob, it drastically reduced the grain yield as apex leaves transfer about 23-91% of photosynthetic matters to developing cobs.

### Stover yield (q ha<sup>-1</sup>)

Nitrogen application significantly influenced the stover yield. Maximum stover yield (126.2 q ha<sup>-1</sup>) recorded under plot receiving 150 kg N ha<sup>-1</sup> followed by application of 100 kg N ha<sup>-1</sup> (Table 1). Chaudhry *et al.*, (1998) revealed that stover yield increases with increasing nitrogen rate. Biomass production and nitrogen availability in soil are directly proportional reported by Delgado (2001). However, the

interaction effect of de-topping and nitrogen levels was non-significant.

### Length of cob (cm)

Cob length is one of the desirable yield components of maize. Significantly maximum cob length of cob (13.4 cm) was obtained in D<sub>3</sub> (no de-topping in hybrid) which was at par D<sub>4</sub> (de-topping in hybrid), on the other hand minimum length of cob was recorded in D<sub>2</sub> (de-topping in African tall). Jalilian and Delkshoshi (2014) [2] also reported similar results of defoliation. The cob length increases significantly with each increase in nitrogen levels. The maximum cob length was reported in N<sub>4</sub> (150 kg N ha<sup>-1</sup>) i.e. (17.6 cm) then other levels of nitrogen.

**Table 3:** Cob length (cm) of maize varieties as influenced by interaction effect of detopping and nitrogen levels on

Cob length (cm)					
Main plot: DT and No DT	Sub plot				Mean
	N <sub>1</sub> : 0	N <sub>2</sub> : 50	N <sub>3</sub> : 100	N <sub>4</sub> : 150	
Fodder type: African tall					
D <sub>1</sub> : No De -topping	7.83	10.50	13.00	19.23	12.64
D <sub>2</sub> : De-topping	7.40	10.00	12.40	16.80	11.65
Grain type: Hybrid 25K55					
D <sub>3</sub> : No De-topping	9.47	11.60	15.07	17.57	13.43
D <sub>4</sub> : De-topping	9.27	11.13	14.70	16.80	12.98
Mean	8.49	10.81	13.79	17.60	
<b>Interaction</b>				<b>S.Em ±</b>	<b>CD (P=0.05)</b>
Comparison of two topping means at the same levels of nitrogen levels				0.46	1.34
Comparison of two nitrogen levels means at the same levels of topping				0.55	1.28

The interaction effect of de-topping and nitrogen levels on length of cob was found significant with maximum (19.23 cm) cob length under treatment combination of D<sub>1</sub> (No de-topping in African tall) and N<sub>4</sub> (150 kg N ha<sup>-1</sup>).

### Cob girth

De-topping showed pronounced effect on girth of cob. The higher cob girth (4.9 cm) was recorded with D<sub>4</sub> (de-topping in

hybrid), were as D<sub>1</sub> (no de-topping) recorded lowest girth of cob (3.9 cm). The girth of cob may give an indication about grain yield. The data shows cob girth was significantly more at N<sub>4</sub> 150 kg ha<sup>-1</sup>, and was at par with (4.7 cm) N<sub>3</sub> 100 kg ha<sup>-1</sup>. Pandey *et al* (2000) [3] have observed that N application improves cob girth and ultimate yield.

**Table 4:** Cob Girth (cm) of maize varieties as influenced by interaction effect of de-topping and nitrogen levels

Cob girth (cm)					
Main plot: DT and No DT	Sub plot				Mean
	N <sub>1</sub> : 0	N <sub>2</sub> : 50	N <sub>3</sub> : 100	N <sub>4</sub> : 150	
Fodder type: African tall					
D <sub>1</sub> : No De -topping	2.82	3.92	4.28	4.61	3.91
D <sub>2</sub> : De-topping	3.57	4.22	4.19	4.48	4.11
Grain type: Hybrid 25K55					
D <sub>3</sub> : No De-topping	4.09	4.58	5.27	5.32	4.82
D <sub>4</sub> : De-topping	4.54	4.76	4.98	5.30	4.89
Mean	3.76	4.37	4.68	4.93	
<b>Interaction</b>				<b>S.Em ±</b>	<b>CD (P=0.05)</b>
Comparison of two topping means at the same levels of nitrogen levels				0.13	0.39
Comparison of two nitrogen levels means at the same levels of topping				0.18	0.58

However, the interaction between de-topping and nitrogen levels was significant. From the table it is clear that the maximum (5.30 cm) cob girth was produced by the treatment combination of D<sub>4</sub> (De- topping in hybrid) and N<sub>4</sub> (150 kg N ha<sup>-1</sup>).

### Number of grains row<sup>-1</sup>

The effect of de-topping has influence on number of grains row<sup>-1</sup>. Significantly more number of grains row<sup>-1</sup> was observed in (24.8) D<sub>4</sub> (de-topping in hybrid). As the there was increment in nitrogen levels the number of grains row<sup>-1</sup> also increased the maximum number of row cob<sup>-1</sup> was observed in N<sub>4</sub> receiving 150 kg N ha<sup>-1</sup>.

### Test weight (g)

The data presented in table 1 showed that de-topping had significant effect on test weight. D<sub>3</sub> (no-de-topping in hybrid) recorded maximum test weight (25.9). Effect of nitrogen

levels on test weight showed significant effect on grain weight. Maximum test weight was recorded at 150 kg N ha<sup>-1</sup> (28.4) were as lowest test weight was recorded in 0 kg N ha<sup>-1</sup> (19.8).

### Shelling percentage

The data on shelling percentage revealed that the maximum shelling percentage (78%) was recorded under hybrid 25K55 with no de- topping, which superior over other main plot treatments and significantly minimum shelling percentage was observed under African tall with de- topping. It is clear from the data that, significantly higher shelling percentage was observed with application of 150 kg N ha<sup>-1</sup>(80.4%). However the interaction of de- topping and nitrogen levels is found to be significant with 80.69% being the highest shelling percent under treatment combination of hybrid 25K55 with de- topping and application of 150 kg N ha<sup>-1</sup>

**Table 5:** Shelling % of maize varieties as influenced by de-topping and nitrogen levels

Shelling %					
Main plot: : DT and No DT	Sub plot				Mean
	N <sub>1</sub> : 0	N <sub>2</sub> : 50	N <sub>3</sub> : 100	N <sub>4</sub> : 150	
Fodder type: African tall					
D <sub>1</sub> : No De -topping	63.77	70.51	74.44	78.95	71.92
D <sub>2</sub> : De-topping	50.03	59.81	73.90	79.21	65.74
Grain type: Hybrid 25K55					
D <sub>3</sub> : No De-topping	70.92	78.15	82.05	83.04	78.54
D <sub>4</sub> : De-topping	65.45	72.26	78.81	80.69	74.30
Mean	62.54	70.18	77.30	80.47	
<b>Interaction</b>				<b>S.Em ±</b>	<b>CD (P=0.05)</b>
Comparison of two topping means at the same levels of nitrogen levels				2.3	6.7
Comparison of two nitrogen levels means at the same levels of topping				3.1	6.9

### Harvest index

The harvest index is maximum under hybrid 25K55 with de-topping i.e., (29.2) which was superior over other treatments. Varied nitrogen levels also significantly influenced harvest index being the maximum (24.7) with the application of 150 kg N ha<sup>-1</sup> which was on par with the application of 100 kg N ha<sup>-1</sup>. However, the interaction of de-topping and nitrogen levels was found to be not significant.

### Conclusion

The findings on response of de-topping and nitrogen levels on yield attributes of maize varieties, resulted that D<sub>3</sub>N<sub>4</sub> no de-topping along with 150 kg N ha<sup>-1</sup> was found to be best in grain yield, length of cob, number of grains row<sup>-1</sup>, test weight, shelling % and it reduced as de-topped. Maximum stover yield was obtained in D<sub>1</sub>N<sub>4</sub> no de-topping in African tall with 150 kg N ha<sup>-1</sup> and harvest index, cob girth was recorded highest in D<sub>4</sub>N<sub>4</sub> hybrid 25K55 with 150kg N ha<sup>-1</sup> when practiced de-topping.

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