

GROWTH AND YIELD OF CHICKPEA AS AFFECTED BY DE-TOPPING TIME AND HEIGHT

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Abstract

The production area of chickpea in Bangladesh is decreasing day by day due to the competition with higher yielding crop which is/or profitable than chickpea. As such, the experiment was undertaken at Regional Agricultural Research Station, Jashore during 2019-2020 and 2020-2021 to study the effect of most suitable method of de-topping (nipping) in chickpea (var. BARI Chola-10) for its growth and yield improvement. Treatments were imposed in a split-plot design where in main plot : time of nipping : 30 days after emergence (DAE) , 40 DAE E₃- 50 DAE and in sub-plot: different heights of nipping practices: Control, Nipping 5 cm from growing tip, Nipping 8 cm from growing tip and Nipping 10 cm from growing tip. In interaction treatment, the highest days to flower (68), days to mature (112), vegetable yield (703 kg ha⁻¹) was observed when chickpea plants were de-topped after 50 DAE at 10 cm from growing tip. The highest plant height (46 cm) was observed when de-topping at 40 DAE was done at 10 cm from growing tip. Seed yield (1419.95 kg ha⁻¹) and Marginal Benefit Cost Ratio (MBCR) (13.1) was recorded maximum when chickpea plants de-topped 50 DAE at 5 cm from growing tip. De-topping practices in chickpea (var. BARI Chola-10) after 50 DAE at 5 cm from growing tip could maximize the productivity of chickpea.

Introduction

Per capita availability of pulses is very low against per capita demand due to back drop of pulses production (Azad *et al.*, 2019). Among the pulse crops chickpea is one of the most important pulses crop in Bangladesh as it contains protein (%) in almost half of its' individual seed weight. Bangladesh has to import a huge amount of chickpea each year due to its huge shortage against demand of production. Removal of apical meristem (apical dominance of auxin) is termed as de-topping / nipping (Khan *et al.*, 1993) which promotes the emergence lateral branches due to role of cytokinins (Campbell *et al.*, 2008). The more the lateral branches the more the flower initiating points that increases yield. Number of branches followed by more pods are the resulted effect of de-topping at various stages of plant growth that boost the grain yield of chickpea (Aziz, 2000; Aslam *et al.*, 2008). Severity of diseases are reduced and yield is increased in case of de-topping at 45 days after sowing (Sumarjit and Sophia, 2006). In addition, de-topped chickpea leaves are a good source of fodder (Zahid *et al.*, 1997). So, this experiment was undertaken to study the effect of de-topping practice along with its time and find out suitable de-topping management in chickpea (var. BARI Chola-10) for yield improvement.

Materials and Methods

The experiment was conducted in the Regional Agricultural Research station, Bangladesh Agricultural Research Institute, Jashore during Rabi season of 2019-20 and 2020-21. The latitude, longitude and altitude of this site is 23°18' N, 89°18' E and 19 m, respectively (Kobir *et al.*, 2020). The site belongs to AEZ-11 n 'High Ganges River Floodplain' (BBS, 2019). The soil of the experimental field was sandy clay-loam in texture with medium high land. Treatments were imposed in a split-plot design where in main plot : Time of de-topping/ nipping (03): i) E₁- 30 days after emergence (DAE) ii) E₂- 40

DAE iii) E₃- 50 DAE an in sub-plot different heights of nipping practices (04): T₁- Control, T₂- Nipping 5 cm from growing tip, T₃- Nipping 8 cm from growing tip, T₄- Nipping 10 cm from growing tip. . The chickpea var. BARI Chola-10 was used. Fertilizers were given as basal as N, P₂O₅, K₂O, S and B @ 20, 40, 20, 20, 1 kg ha⁻¹, respectively. Different parameters on growth, yield components and yield of chickpea were studied. Data were tabulated by Microsoft excel software and data were analyzed by statistical software “R” packages.

Results and Discussion

Results revealed that treatment nipping had significant influence on plants m⁻², days to flower, days to maturity, plant height, pods plant⁻¹, vegetable production ha⁻¹ and seed yield ha⁻¹ (Table 1). Nipping at 40 DAE showed maximum t values of days to maturity, pods plant⁻¹, branches plant⁻¹, seed yield and followed by nipping at 50 DAE but only vegetable yield was highest with later nipping and followed by 10 days earlier this practice. Nipping 30 DAE was proved comparatively lower in each parameter.

Table 1. Growth and yield of chickpea as affected by nipping (Pooled over the years)

Treatments	Plants m ⁻² (no.)	Days to flowering (no.)	Days to maturity (no.)	Plant height (cm)	Pods plant ⁻¹ (no.)	Branches plant ⁻¹ (no.)	Vegetable production (kg ha ⁻¹)	Seed yield (kg ha ⁻¹)
E ₁	22	62	114	42	21	2	123	663
E ₂	32	64	116	44	28	3	212	1201
E ₃	38	65	115	39	26	3	385	1150
CV (%)	6.98	1.25	0.75	11.45	17.35	12.20	19.68	18.00
LSD(0.05)	2.13	0.77	0.91	2.97	3.89	NS	55.63	242.68

E₁-30 days after emergence, E₂-40 days after emergence, E₃-50 days after emergence

Plants m⁻², days to flower, vegetable production ha⁻¹ and seed yield ha⁻¹ were significantly varied due to nipping point when days to maturity, plant height, pods plant⁻¹, branches plant⁻¹ did not response with the practice (Table 2).

Table 2. Growth and yield of chickpea as affected by different height of nipping (Pooled over the years)

Treatments	Plants m ⁻² (no.)	Days to flowering (no.)	Days to maturity (no.)	Plant height (cm)	Pods plant ⁻¹ (no.)	Branches plant ⁻¹ (no.)	Vegetable production (kg ha ⁻¹)	Seed Yield (kg ha ⁻¹)
T ₁	31	63	115	43	25	3	0	894
T ₂	30	64	115	41	28	3	223	1150
T ₃	30	64	115	43	25	3	283	1068
T ₄	33	65	115	41	22	3	455	974
CV (%)	6.96	1.37	0.61	7.46	26.91	15.39	14.54	14.10
LSD(0.05)	2.1	0.84	NS	NS	NS	NS	57.59	232.00

T₁- Control, T₂- Nipping 5 cm from growing tip, T₃- Nipping 8 cm from growing tip, T₄- Nipping 10 cm from growing tip Nipping 10 cm growing tip gave maximum plants m⁻², days to flower, vegetable production ha⁻¹ and at par with other nipping times but vegetable yield was obtained highest with de-topped 10 cm tip. Numerically greater number of pods plant⁻¹ was registered with nipping 5 cm growing tip, that treatment increased seed yield maximum and followed by 8 and 10 cm nipping. Treatment no nipping (control) had no additional vegetable yield and poor seed yield thus knocking at nipping practices.

In case of combined effect, the highest plant height was found when chickpea plants de-topped after 40 days of emergence at 10 cm from growing tip and the lowest plant height was found when chickpea plants were de-topped after 50 days of emergence at both 10 cm and 5 cm from growing tip. When chickpea plants were de-topped in 40 days after emergence at 10 cm from growing tip, the plants get

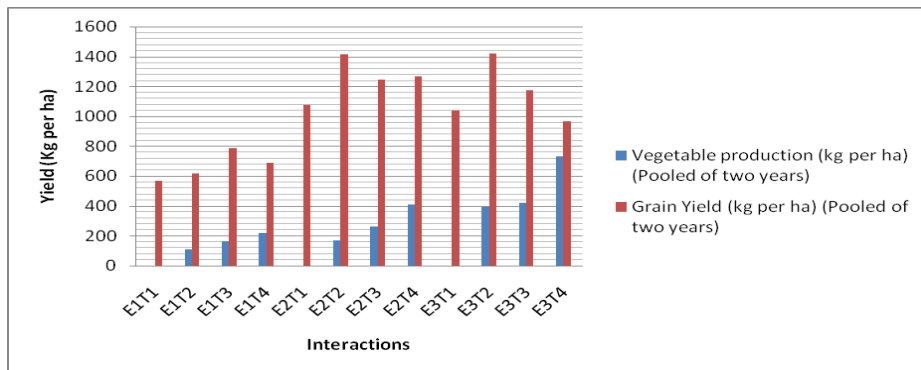
adequate days to attain highest apical height which is not possible when chickpea were de-topped in 50 days after emergence. Aslam *et al.* (2008) however pointed out that vigorous cutting of chickpea plants is related to tallest plant. The highest plants m^{-2} , days to flower and days to mature was recorded when chickpea plants de-topped 50 DAE at 10 cm from growing tip. On the other hand, the lowest plants m^{-2} , days to flower and days to mature was observed when chickpea plants de-topped after 30 DAE at 5 cm from growing tip, not de-topped at 30 DAE, respectively (Table 3). Gaudreau *et al.* (2020) claimed that de-topping in later stage of vegetative growth, the auxiliary inflorescence can only initiate after the recovery period which can delay the overall growth of the plant thus maturity gets later. But de-topping in early stage of vegetative growth, the plants can get adequate days to flower after recovering from pruning. The highest branches $plant^{-1}$ was found when chickpea plants were not de-topped at 40 days after emergence and the lowest branches $plant^{-1}$ was found when chickpea plants were de-topped after 30 days of emergence at 10 cm from growing tip. The highest pods $plant^{-1}$ was found when chickpea plants de-topped after both 40 and 50 days of emergence at 5 cm from growing tip and the lowest pods $plant^{-1}$ was found when chickpea plants were de-topped after 30 days of emergence at 10 cm from growing tip (Table 3).

Table 3. Combined effect of nipping time and height on phenology of chickpea (Pooled basis of two year)

Combined treatment	Plants m^{-2} (no.)	Days to flowering (no.)	Days to maturity (no.)	Plant height (cm)	Pods $plant^{-1}$ (no.)	Branches $plant^{-1}$ (no.)
E ₁ T ₁	28	57	112	41.5	23	3
E ₁ T ₂	16	62	114	41.5	21	3
E ₁ T ₃	18	62	114	42.5	21	2
E ₁ T ₄	23	64	115	40	15	2
E ₂ T ₁	28	60	114	45	26	3
E ₂ T ₂	31	63	115	42	30	3
E ₂ T ₃	33	65	116	45.5	26	3
E ₂ T ₄	34	65	117	44.5	28	3
E ₃ T ₁	35	60	113	41	24	3
E ₃ T ₂	38	64	114	38	30	3
E ₃ T ₃	38	65	116	39	27	3
E ₃ T ₄	41	67	118	38	21	3
CV (%)	6.96	1.37	0.61	7.46	17.91	15.39
LSD _(0.05)	3.79	1.48	1.68	5.95	10.66	0.70

E₁-30 days after emergence, E₂-40 days after emergence, E₃-50 days after emergence,

T₁- Control, T₂- Nipping 5 cm from growing tip, T₃- Nipping 8 cm from growing tip, T₄- Nipping 10 cm from growing tip
 In the pooled basis of analysis, the highest vegetable yield was found from de-topping after 50 days of emergence at 10 cm from growing tip and the lowest vegetable yield was found when chickpea crops not de-topped in 30, 40 and 50 days after emergence (Figure 1). The highest seed yield was found from de-topping after 50 days of emergence at 5 cm from growing tip and the lowest seed yield was found when chickpea crops were not de-topped in 30 days after emergence (Figure 1). This may be happened due to light nipping at certain period of time can enhance plant height, branches $plant^{-1}$, pods $plant^{-1}$, days to flower as well as days to mature, those lead to increase in seed yield. Aslam *et al.* (2010) reported that removal of 2 cm from growing tip at 70 days after sowing gave the highest seed yield and the lowest seed yield was found in control. Similar trend also found by Even and Wahab (1983) and Othman and Wan (1987).



E₁-30 days after emergence, E₂-40 days after emergence, E₃-50 days after emergence,
T₁- Control, T₂- Nipping 5 cm from growing tip, T₃- Nipping 8 cm from growing tip, T₄- Nipping 10 cm from growing tip

Fig.1. Combined effect of nipping time and height on vegetable and grain yield of chickpea.

Cost analysis: Partial cost analysis of chickpea de-topping showed that the highest total additional taka over control and marginal benefit cost ratio achieved when chickpea crops was de-topped in 50 DAE at 5 cm from growing tip (E₃T₂). The lowest total additional taka over control and marginal benefit cost ratio calculated when chickpea crops were de-topped in 30 days after emergence at 5 cm from growing tip (E₁T₂) (Table 4).

Table 4. Partial cost analysis of different treatment combinations (2019-20 and 2020-21)

Combined Treatment	Total Add. TK. over control			Cost of treatment			MBCR		
	2019-20	2020-21	Mean	2019-20	2020-21	mean	2019-20	2020-21	Mean
E ₁ T ₁	-	-	-	-	-	-	-	-	-
E ₁ T ₂	9988.8	8420	9204.4	3600	3600	3600	2.7	2	2.3
E ₁ T ₃	25216.0	23580	24398	4800	4800	4800	5.2	5	5.1
E ₁ T ₄	21195.3	19550	20372.6	7000	7000	7000	3.0	3	3.0
E ₂ T ₁	-	-	-	-	-	-	-	-	-
E ₂ T ₂	34041.6	32450	33245.8	3600	3600	3600	9.4	9	9.2
E ₂ T ₃	34041.6	25595	29818.3	4800	4800	4800	7.0	7	7.0
E ₂ T ₄	37147.4	35180	36163.7	7000	7000	7000	5.0	5	5.1
E ₃ T ₁	-	-	-	-	-	-	-	-	-
E ₃ T ₂	51612.2	44755	48183.6	3600	3600	3600	14.3	12	13.1
E ₃ T ₃	34151.5	30900	32525.7	4800	4800	4800	7.1	6	6.5
E ₃ T ₄	41966.6	38665	40315.8	7000	7000	7000	5.9	6	5.9

E₁-30 days after emergence, E₂-40 days after emergence, E₃-50 days after emergence,
T₁- Control, T₂- Nipping 5 cm from growing tip, T₃- Nipping 8 cm from growing tip, T₄- Nipping 10 cm from growing tip, MBCR=Marginal benefit cost ratio

Input price: (Tk./ kg) Urea-16⁻¹, TSP-22⁻¹, MoP-15⁻¹, Gypsum-06, Power tiller (1 pass): Tk. ha⁻¹ 2250⁻¹, irrigation Tk. kg⁻¹ (1 time): 900, labor: Tk. Day⁻¹ 400 08 hours⁻¹, Tk. kg chickpea seed-120⁻¹

Output price: Tk. / kg : Chickpea-70⁻¹, Vegetable-55

Conclusion

From the above findings, it can be concluded that growth and yield of chickpea is affected by de-topping practice. Seed yield was maximum when chickpea plant (var. BARI Chola-10) is de-topped after 50 DAE (Days After Emergence) at 5 cm from growing tip followed by highest marginal benefit cost ratio.

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