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Effect of topping under different nitrogen levels on agronomic characters of cotton

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ABSTRACT

An experiment was conducted to study the effect of topping under different nitrogen levels on growth, yield and quality of cotton (*Gossypium hirsutum* L.) (Bt. Cotton) at Agronomic Research Area, University of Agriculture, Faisalabad, during kharif 2017. The experiment was laid out in Randomized Complete Block design (RCBD) with factorial arrangement having three replications. Treatments included; A) Four topping levels; control (No topping), topping at 90 cm, 120 cm and 150 cm height, B) Three nitrogen levels; 150 kg ha^{-1}, 200 kg ha^{-1} and 250 kg ha^{-1}. Upper 3-4 cm portion of terminal bud of main stem was removed when plant height was 3-4 cm more as per treatment to maintain the height of plants as per treatment (70-100 days after sowing) by regular visits. All other agronomic practices were kept normal and uniform. The data regarding the agronomic parameters were collected and statistically analyzed using Fisher's analysis of variance technique and the treatments' means were compared by using Tukey's HSD (Honestly significant difference) test at 5% probability. Effect of nitrogen rate, topping as well as their interactive effect was significant on total number of bolls per plant. A comparison of all interaction values showed maximum total number of bolls per plant in plots where plants were applied with 250 kg N ha^{-1} and topping was done at 150 cm height which were equal to the total number of bolls per plant in plots where plants were applied with 200 kg N ha^{-1} and topping was done at 120 cm height. While significantly less total number of bolls was recorded when no topping was done and topping was done at 150 cm height when plants were applied with 150 kg N ha^{-1}. Effect of nitrogen rate and topping was significant but their interactive effect was non-significant on number of aborted sites per plant. As we increased nitrogen above 200 kg ha^{-1} number of aborted sites per plant also increased. As plant height increased number of aborted sites per plant also increased. Effect of nitrogen rate and topping was significant but their interactive effect was non-significant on number of infested bolls

per plant. As we increased nitrogen above 200 kg ha^{-1} number of infested bolls per plant also increased. As plant height increased number infested bolls per plant also increased. Effect of nitrogen rate, topping as well as their interactive effect was significant on seed cotton yield. At 150 kg N ha^{-1} maximum seed cotton yield was produced when topping was done at 90 cm height. When we applied nitrogen at the rate of 200 kg ha^{-1} maximum seed cotton yield was obtained when topping was performed at 120 cm height. At nitrogen application rate of 250 kg ha^{-1} maximum seed cotton yield was obtained when toping was done at 150 cm height. A comparison of all interaction values showed maximum seed cotton yield in plots where plants were applied with 200 kg N ha^{-1} and topping was done at 120 cm height. Effect of nitrogen rate was significant but effect of topping and their interactive effect was non-significant on ginning out turn (%). As nitrogen application increased ginning out turn also increased. At 250 kg N ha^{-1} maximum ginning out turn (%) was recorded.

Key words: cotton, nitrogen level, topping

INTRODUCTION

Agriculture is pivotal for the sustainable economy and development in Pakistan. In gross domestic product it shares 19.8 percent and is also a source for employment for 42.3 percent of the labor of country (Anonymous 2015-16). Cotton is a high quality fiber crop and plays decisive role in uplifting country exports that result in high foreign reserves. Cotton shares 1.0 percent share in the GDP of the country moreover it adds 5.1 percent in the agriculture value. The high production of quality cotton can take the economy of Pakistan towards progress prosperity and bonanza. Nitrogen (N) is known as the most limiting mineral nutrient in production of cotton. It plays a vital role as a building block of proteins and synthesis of chlorophyll. Cotton lint is actually an extension of the cell wall of its seed. Therefore, if no seed is produced, then no lint will also be produced. Unlike cereal grains, cotton can be affected by both under and over fertilization. Under-fertilization can cause reduction in development of fruiting site, leading to abortion of bolls, reduction in lint yield, fiber length and strength. Excessive vegetative growth (rank growth) takes place as a result of over-fertilization, so, more plant growth regulator are required to stop the unwanted growth. Over use of fertilizers also reduced the lint turn out, possibly increased occurrence of Verticillium wilt disease, delayed maturity resulting in immature fiber (low micronaire), adverse effects on harvest aid chemical treatment efficacy, and ultimately resulting in lower lint yield and fiber quality (Main *et al*., 2010; Main *et al*., 2011). Due to high nitrogen, decreased lint percentage, increased boll weight, mineral uptake and photosynthate assimilation in sink was noted (Sawan *et al*., 2006). It is reported that there was no effect of nitrogen on fiber uniformity (Hussain *et al*., 2000). Nitrogen is required for cotton production in large amount more consistently than all other nutrients (Hou *et al*., 2007). So nitrogen nutrition play pivotal role in cotton production (Bondada and Oosterhuis, 2001).

It is noted that removal of terminal bud of main stem (topping) and side pruning of branches play an important role in adjusting plant geometry of cotton plants on fertile soils which results in elimination of lodging when high nitrogen rates are applied. Lint yield increased when topping of cotton plant is performed (Hosny *et al*., 1995). Topping also plays role in controlling bollworm infestation (Renou *et al*., 2011). Yield increased as a result of topping and pruning (Yang *et al*., 2008). Removal of the apical bud resulted in a large accumulation of assimilates in the root system, which suggests that there is more flow of nutrients to the sinks and resultantly more assimilates move towards the old fruits or for initiating new and additional fruits (El-Debaby *et al*., 1995). Pruning and topping can cause readjustments of assimilate partitioning in plants resulting in strengthening of reproductive growth and inhibiting vegetative growth; this may lead to early maturity of cotton (Xu *et al*., 2001; Dai *et al*., 2003). Topping and pruning although reduced total fruiting sites but number of retained bolls increased due to less abscission of fruit sites. Although total dry matter decreased but allocation of dry matter to reproductive organs increased, this ultimately gave high cotton lint yield. Although number of main stem nodes stopped to form after topping but topping and pruning increased the biomass allocation to reproductive organs like green and opened bolls (Yang *et al*., 2008). Through pruning and topping, decrease in plant height and number of main stem nodes, and increase in number of retained bolls and cotton yield was noted (Ma *et al*., 2004; Obasi and Msaakpa, 2005). Topping at 120 cm height results in increased number of fruiting sites and retended bolls, decreased number of aborted sites and increased boll weight and boll percentage and ultimately high seed cotton yield (Obasi and Msaakpa, 2005). Due to topping of Pima cotton at interval of 15 days (starts from mid-July), plant height and number of main stem nodes decreased while boll set on top sympodia, boll number and number of additional

branch nodes on top fruiting branch increased. But there was no effect of topping on boll weight, lint yield and days to boll maturity and it was also noted that there was less effect of topping when applied later in season (Naguib *et al*., 1987). In another study it was reported that topping have no significant effect on yield and yield components (Siddique *et al*., 2002).

At the emergence of 15th sympodia or 10 days after opening of first flower topping was performed. In this six years experiment there was no effect on yield of seed cotton but bollworm infestations were less in topped cotton than non-topped cotton. Seven trials out of 12 were in favor of topping which show less bollworm infestations (Renou *et al*., 2011). Topping was performed at different growth stages (3-4, 6-7, 9-10 and 12-13 sympodial branches) in an experiment and results showed highest yield when topping was done at 12-13 sympodial branches stage (Basnet, 2006). From above review it is concluded that use of optimum level of nitrogen and topping at appropriate time can improve/alter cotton growth, earliness, yield and quality.

MATERIALS AND METHODS

An experiment was conducted to study the effect of topping under different nitrogen levels on growth, yield and quality of cotton (*Gossypium hirsutum* L.) (Bt. Cotton) at Agronomic Research Area, University of Agriculture, Faisalabad, by using RCBD with factorial arrangements having 3 replications during kharif 2017. The experiment was comprised of the following treatments; Factor A Topping (T): T_0 = Control (No Topping), T_1 = Topping at 90 cm height, T_2 = Topping at 120 cm height, T_3 = Topping at 150 cm height; Factor B Nitrogen rate (N) N_1 = 150 kg ha^{-1} , N_2= 200 kg ha^{-1}, N_3=250 kg ha^{-1} Seed bed was prepared by cultivating one time with rotavator and two times with tractor mounted cultivator each followed by planking. Then 75 cm apart ridges were made by tractor mounted ridger. The crop was sown on sandy clay loam soil on May 24, 2013 using 20 kg seed ha^{-1}. Seed was placed on one side of ridges at distance of 30 cm. Full dose of phosphorus (115 kg ha^{-1}) and potassium (95 kg ha^{-1}) and one third dose of nitrogen (as per treatment) was applied at sowing while one third at 30-35 days after sowing and remaining nitrogen was applied at flowering (60-65 DAS). Weeds were controlled by one pre emergence herbicide {Dual Gold (S Metachlore) at rate of 2000 mL ha^{-1}} sprayed 23 hours after sowing, two hoeings (first 25 days after sowing and second 50 days after sowing) and one post emergence broad spectrum herbicide (Roundup (Glyphosate) at the rate of 3000 mL ha^{-1}) using shield (90 days after sowing). Insects were controlled by spraying proper insecticides (Imidachloprid at the rate of 625 mL ha^{-1}) at proper time (first 70 days after sowing and second 90 days after sowing). Upper 3-4 cm portion of terminal bud of main stem was removed when plant height was 3-4 cm more as per treatment to maintain the height of plants as per treatment (70-100 days after sowing) by regular visits. All other agronomic practices were kept normal and uniform for all the treatments. When seedlings were established, ten true representative plants were selected randomly from each plot and tagged them to record data. Data on following agronomic parameters (Number of monopodial branches per plant, number of bolls per plant, Boll weight (g), Seed index (g), Seed cotton yield per plant (g), Seed cotton yield per ha (kg) and Ginning out turn (GOT) %, were recorded using standard procedures. Data collected were statistically analyzed using Fisher's analysis of variance technique (Steel *et al*., 1997) and the treatments' means were compared by using Tukey's HSD (Honestly Significant Difference) test at 5% probability. Statistix software was used for statistical analysis and graphs were made by using Microsoft Excel Program.

RESULTS AND DISCUSSION

Earliness index (%)

Effect of nitrogen rate, topping as well as their interactive effect was significant on earliness index (table 1). At 150 kg N ha^{-1} maximum earliness index (59.93%) was recorded when topping was done at 90 cm height followed by earliness index (54.43%) when topping was done at 120 cm height. Minimum earliness index (47.83%) was noted in control which was at par with the earliness index (50.0%) noted in plants topped at 150 cm height. The reason is that at low nitrogen level there was less vegetative growth and more reproductive growth which caused more earliness. When topping was done at less height there was early and more light penetration resulting in more and early boll opening so, earliness index was more. While when height increased as in all other treatments there was less light penetration and delay in boll opening so, earliness was decreased. When we applied nitrogen at the rate of 200 kg ha^{-1} maximum earliness index (48.52%) was recorded when topping was performed at 120 cm height which was at par with earliness index when topping was done at 90 cm height (47.85%) or at 150 cm height (46.08%). While minimum earliness index was recorded

in control (44.35%). In this case 120 cm tall plants supplied with 200 kg N ha^{-1} performed better because nitrogen dose and plant height were enough that there was no extra vegetative growth so light penetration was also more which caused more earliness index. In case of 90 cm height where earliness index was minimum more nitrogen caused unwanted vegetative growth or sprouting of branches from top nodes leading less light penetration and less earliness index. Similarly, in no topping and topping at 150 cm height more nitrogen was used for vegetative growth than for reproductive growth so light penetration was less which decreased earliness index.

At nitrogen application rate of 250 kg ha^{-1} maximum earliness index (44.32%) was recorded when topping was done at 150 cm height which was at par with other two topping levels. While minimum earliness index (38.66%) was recorded at control which was at par with earliness index (41.33%) when topping was done at 150 cm height. The reason is that with taller plants more nitrogen was used for vegetative growth which caused less penetration resulting in less earliness index. A comparison of all interaction values showed maximum earliness index (59.93%) in plots where plants were applied with 150 kg N ha^{-1} and topping was done at 90 cm height because this treatment combination allowed enough vegetative growth to allow more light penetration resulting in more earliness index.

Table-1: Effect of topping under different nitrogen levels on earliness index (%) in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	6.43	3.215	
Nitrogen rate (N)	2	719.11	359.555	122.66*
Topping (T)	3	274.86	91.618	31.26*
N x T	6	80.63	13.438	4.58*
Error	22	64.49	2.931	
Total	35	1145.51		

* = Significant

B. Comparison of treatments' means

Topping (T) / **Nitrogen rate (N)**	**T_0 = Control (No Topping)**	**T_1 = Topping at 90 cm height**	**T_2 = Topping at 120 cm height**	**T_3 = Topping at 150 cm height**	**Means**
N_1 = 150 kg ha^{-1}	47.83 C	59.93 A	54.43 B	50.0 C	53.05 A
N_2 = 200 kg ha^{-1}	44.35 B	47.85 AB	48.52 A	46.08 AB	46.70 B
N_3 = 250 kg ha^{-1}	38.66 B	44.29 A	44.32 A	41.33 AB	42.15 C
Means	43.61 B	50.69 A	49.09 A	45.80 B	

Means not sharing a letter in common within a row differ significantly at 5% probability.

Tukey's HSD value (5%) for simple effect of topping on nitrogen rates (Interaction) = 3.882

Tukey's HSD value (5%) for Nitrogen means = 1.756

Tukey's HSD value (5%) for Topping means = 2.241

Number of monopodial branches per plant

Effect of nitrogen rate was significant but effect of topping and their interactive effect was non-significant on number of monopodial branches per plant (table 2). At 250 kg N ha^{-1} maximum number of monopodial branches per plant (0.81) was recorded followed by the number of monopodial branches per plant at 200 kg N ha^{-1} (0.67) and minimum number of monopodial branches per plant (0.33) was recorded at 150 kg N ha^{-1}. It shows that as we increased nitrogen rate, number of monopodial branches per plant also increased which means days to maturity also increased (earliness decreased). The reason is that with increase of nitrogen more vegetative growth takes place in plants so maturity delays and number of monopodial branches (vegetative branches) per plant increases.

Table-2: Effect of topping under different nitrogen levels on number of monopodial branches per plant in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	0.02420	0.01210	
Nitrogen rate (N)	2	1.45005	0.72502	59.92*
Topping (T)	3	0.00907	0.00303	0.25^{NS}
N x T	6	0.01815	0.00303	0.25^{NS}
Error	22	0.26620	0.01210	
Total	35	1.76767		

* = Significant NS = Non-Significant

B. Comparison of treatments' means

Topping (T) / **Nitrogen rate (N)**	**T_0 = Control (No Topping)**	**T_1 = Topping at 90 cm height**	**T_2 = Topping at 120 cm height**	**T_3 = Topping at 150 cm height**	**Means**
N_1 = 150 kg ha^{-1}	0.33	0.33	0.33	0.33	0.33 C
N_2 = 200 kg ha^{-1}	0.67	0.67	0.67	0.67	0.67 B
N_3 = 250 kg ha^{-1}	0.78	0.78	0.78	0.89	0.81 A
Means	0.59	0.59	0.59	0.63	

Means not sharing a letter in common differ significantly at 5% probability.

Tukey's HSD value (5%) for Nitrogen means = 0.113

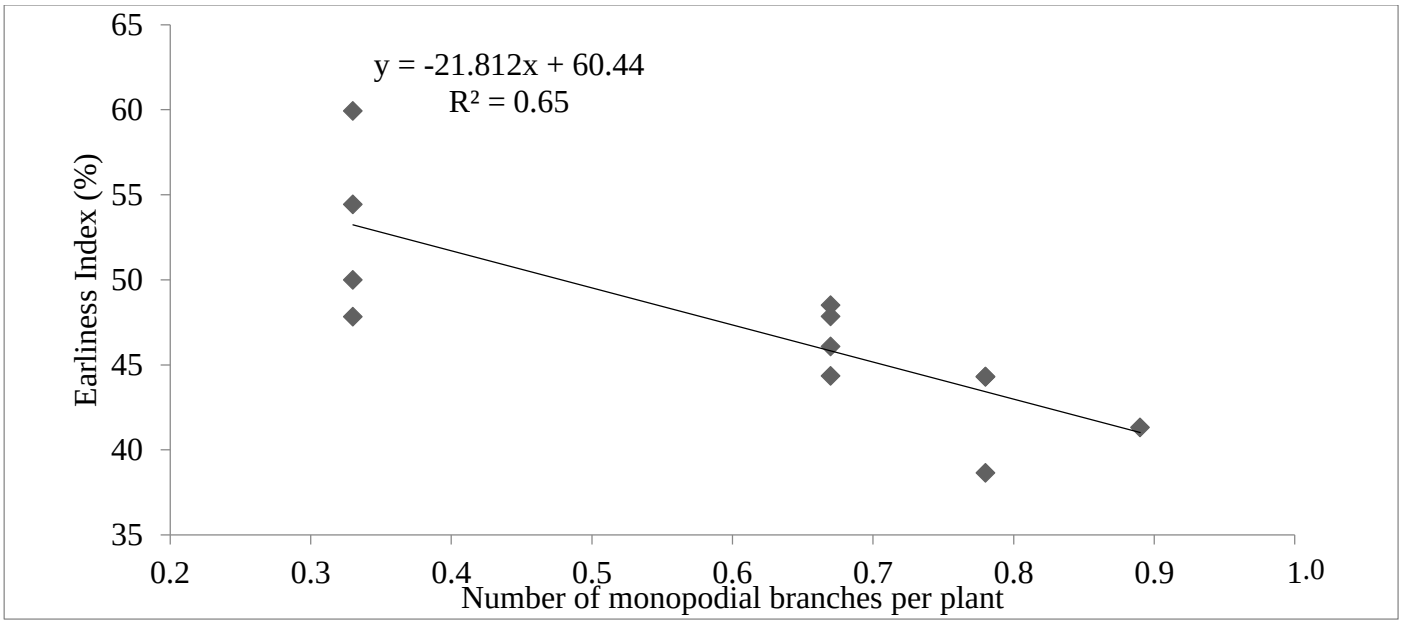

Fig-1: Relationship between number of monopodial branches per plant and earliness index (%) in cotton

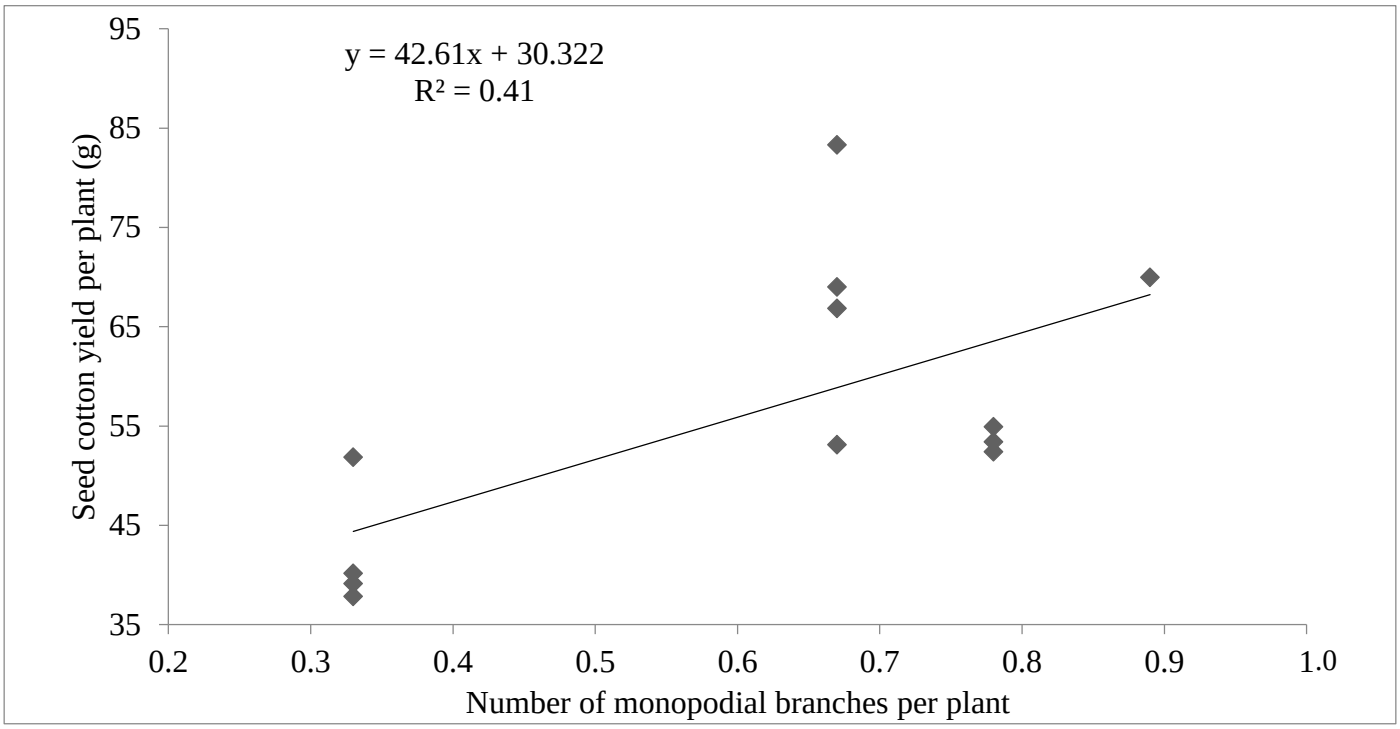

Fig-2: Relationship between number of monopodial branches per plant and seed cotton yield per plant (g).

Total number of bolls per plant

Effect of nitrogen rate, topping as well as their interactive effect was significant on total number of bolls per plant (table 3). At 150 kg N ha^{-1}total number of bolls per plant was non-significantly different from each other (at par with each other) at all topping times and control. It shows that at lower level of nitrogen topping has no effect on total number of bolls per plant. The reason is that at low nitrogen level vegetative growth was suppressed so, some nitrogen was used for vegetative growth and some for reproductive growth.

When we applied nitrogen at the rate of 200 kg ha^{-1} maximum total number of bolls per plant(28.33) was recorded when

topping was performed at 120 cm height which was at par with total number of bolls per plant(26.33) when topping was done at 150 cm and control (26.45). While significantly less bolls per plant (20.89) were recorded when topping was done at 90 cm height. In this case 120 cm tall plants performed better because more nitrogen was available to support more fruits similarly in 150 cm height and control due to more height total number of bolls per plant were at par with 120 cm tall plants but in case of 90 cm height where total number of bolls per plant were minimum more nitrogen caused unwanted vegetative growth or sprouting of branches from top nodes due to less height leading to less bolls per plant. At more height nitrogen was enough to support more number of bolls.

At nitrogen application rate of 250 kg ha^{-1} maximum total number of bolls per plant (28.78) was recorded when topping was done at 150 cm height which was at par with total number of bolls per plant (26.22) at control. While minimum total number of bolls per plant (22.22) were recorded when topping was done at 90 cm height. It shows that as height increased total number of bolls per plant also increased with more application of nitrogen. But at less height it led to unwanted vegetative growth.

A comparison of all interaction values showed maximum total number of bolls per plant (28.78) in plots where plants were supplied with 250 kg N ha^{-1} and topping was done at 150 cm height which were equal to the total number of bolls per plant (28.33) in plots where nitrogen was applied at 200 kg ha^{-1} and topping was done at 120 cm height. Because plants retended maximum bolls, less boll abortion and more reproductive growth due to optimum nitrogen for the respective height of plants. R^2 (0.82) indicated that the relationship between total number of bolls per plant and seed cotton yield per plant (g) was strong and positive (fig 3).

Table-3: Effect of topping under different nitrogen levels on total number of bolls per plant in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	12.086	6.043	
Nitrogen rate (N)	2	593.80	296.90	113.59*
Topping (T)	3	49.329	16.443	6.29*
N x T	6	132.021	22.004	8.42*
Error	22	57.503	2.614	
Total	35	844.739		

* = Significant

B. Comparison of treatments' means

Topping (T) / **Nitrogen rate (N)**	**T_0 = Control (No Topping)**	**T_1 = Topping at 90 cm height**	**T_2 = Topping at 120 cm height**	**T_3 = Topping at 150 cm height**	**Means**
N_1 = 150 kg ha^{-1}	16.0 A	18.56 A	16.45 A	16.0 A	16.75 B
N_2 = 200 kg ha^{-1}	26.45 A	20.89 B	28.33 A	26.33 A	25.50 A
N_3 = 250 kg ha^{-1}	26.22 AB	22.22 C	23.67 BC	28.78 A	25.22 A
Means	22.89 A	20.56 B	22.82 A	23.70 A	

Means not sharing a letter in commonwithin a row differ significantly at 5% probability.

Tukey's HSD value (5%) for simple effect of topping on nitrogen rates (Interaction) = 3.666

Tukey's HSD value (5%) for Nitrogen means = 1.678

Tukey's HSD value (5%) for Topping means = 2.117

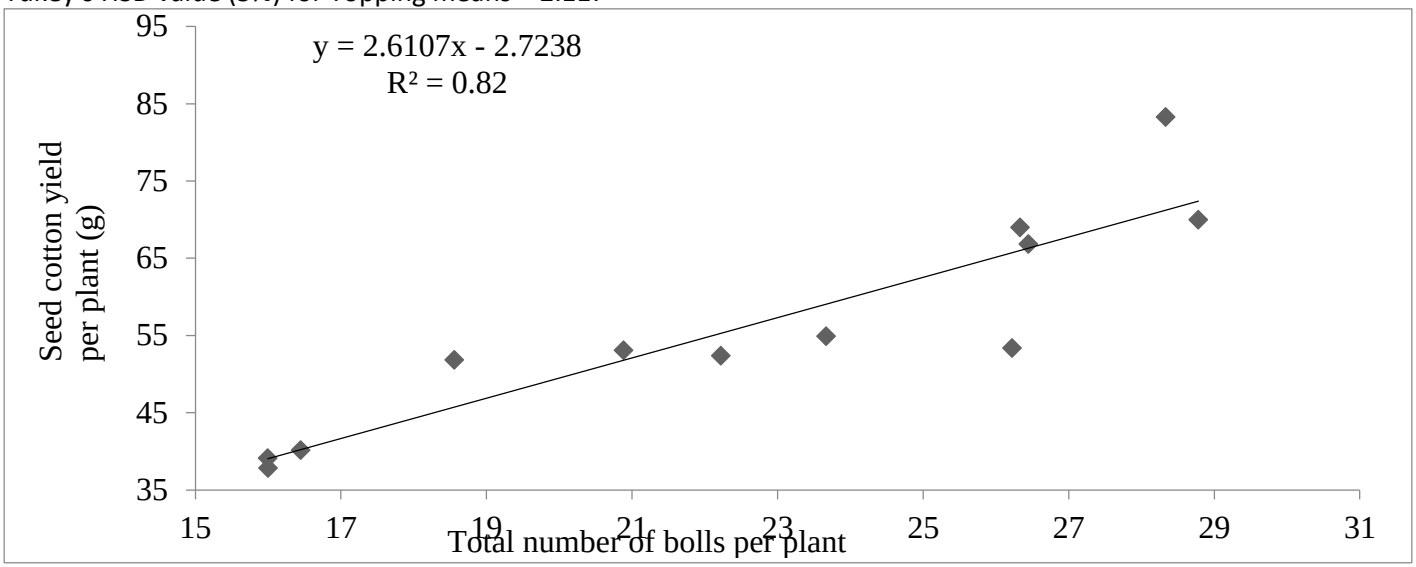

Fig-3: Relationship between total number of bolls per plant and seed cotton yield per plant (g)

Number of infested bolls per plant

Effect of nitrogen rate and topping was significant but their interactive effect was non-significant on number of infested bolls per plant (table 4). At 250 kg N ha^{-1} significantly highernumber of infested bolls per plant (2.81) was recorded than other two nitrogen levels where aborted sites were recorded which were at par with each other. It shows that as we use excessive nitrogen it resulted in more infestation of bolls. Use of more nitrogen than optimum resulted in excessive vegetative growth instead of reproductive growth thus less light penetration and air circulation resulting in more boll infestation.

Maximum number of infested bolls per plant (3.55) was recorded when no topping (control) was done followed by the number of infested bolls per plant (2.41) when topping was done at 150 cm height while minimum number of infested bolls per plant (1.63) was recorded when topping was done at 90 cm height which was at par with number of infested bolls per plant (1.89) when topping was done at 120 cm height. It shows that as height increased number of infested bolls per plant was also increased. The reason is that at less height more nutrients were used for reproductive growth which supported more boll retention and less boll infestation because when plants were small then there was more light penetration and air circulation which reduced boll infestation.

Table-4: Effect of topping under different nitrogen levels on number of infested bolls per plant in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	0.6760	0.338	
Nitrogen rate (N)	2	3.6458	1.8229	12.96*
Topping (T)	3	19.6738	6.55794	46.62*
N x T	6	1.7429	0.29048	2.07^{NS}
Error	22	3.0946	0.14066	
Total	35	28.8331		

* = Significant NS = Non-Significant

B. Comparison of treatments' means

Topping (T)	T_0 = Control (No Topping)	T_1 = Topping at 90 cm height	T_2 = Topping at 120 cm height	T_3 = Topping at 150 cm height	

Nitrogen rate (N)					Means
N_1 = 150 kg ha^{-1}	3.0	1.44	1.78	2.0	2.05 B
N_2 = 200 kg ha^{-1}	3.33	1.67	1.89	2.11	2.25 B
N_3 = 250 kg ha^{-1}	4.33	1.78	2.0	3.11	2.81 A
Means	3.55 A	1.63 C	1.89 C	2.41 B	

Means not sharing a letter in common differ significantly at 5% probability.
Tukey's HSD value (5%) for Nitrogen means = 0.385
Tukey's HSD value (5%) for Topping means = 0.491

Boll weight (g)

Effect of nitrogen rate, topping as well as their interactive effect was non-significant on boll weight (table 5) because boll weight, mainly, is a genetically controlled character.

These results were in contrast to results that nitrogen significantly affected boll weight (Saleem*et* al., 2010; Seilsepour*et al*., 2013). However, non-significant effects of topping and pruning were also noted on boll weight (Ma *et al*., 2004; Obasi and Msaapka, 2005). R^2 (0.92) indicated that there was strong and positive relationship between boll weight (g) and seed cotton yield per plant (g) (fig 4).

Table-5: Effect of topping under different nitrogen levels on boll weight (g) in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	0.18517	0.9259	
Nitrogen rate (N)	2	0.40524	0.20262	1.40^{NS}
Topping (T)	3	0.00232	0.00077	0.0053^{NS}
N x T	6	0.15001	0.02500	0.17^{NS}
Error	22	3.17889	0.14450	
Total	35	3.92163		

NS = Non-Significant

B. Comparison of treatments' means

Topping (T) / Nitrogen rate (N)	T_0 = Control (No Topping)	T_1 = Topping at 90 cm height	T_2 = Topping at 120 cm height	T_3 = Topping at 150 cm height	Means
N_1 = 150 kg ha^{-1}	2.97	3.10	2.90	2.95	2.98
N_2 = 200 kg ha^{-1}	3.23	3.14	3.35	3.24	3.23
N_3 = 250 kg ha^{-1}	3.15	3.13	3.10	3.22	3.15

Means	3.11	3.12	3.12	3.14	

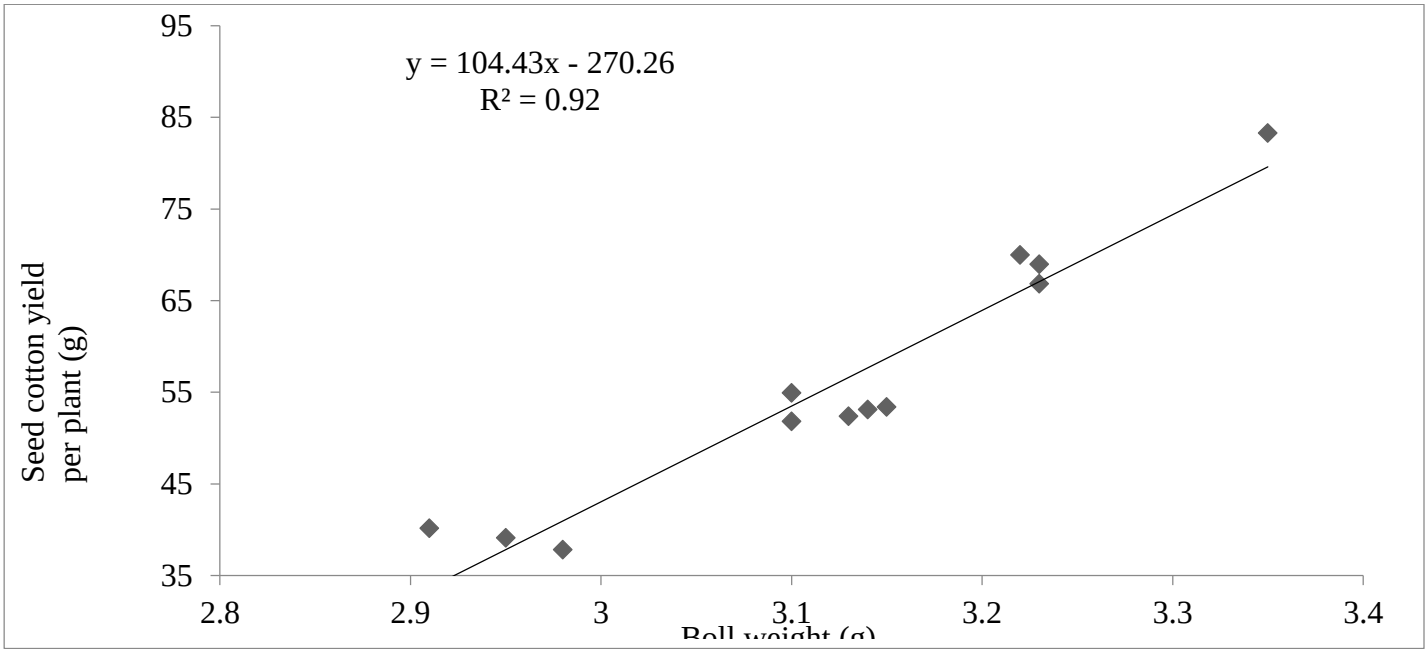

Fig-4: Relationship between boll weight (g) and seed cotton yield per plant (g)

Seed index (g)

Topping and nitrogen rate did not significantly affectthe seed indexand their interactive effect was also non-significant on seed index (table 6) as it is also a genetically controlled character. These results were in contrast to results that nitrogen significantly affected seed weight (Sawan*et* al., 2009). While non-significant effects of topping and pruning were also noted on boll weight (Ma *et al*., 2004; Obasi and Msaapka, 2005).

Table-6: Effect of topping under different nitrogen levels on seed index (g) in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	0.0356	0.01778	
Nitrogen rate (N)	2	0.1293	0.06465	0.16^{NS}
Topping (T)	3	1.2394	0.41315	1.00^{NS}
N x T	6	4.4918	0.74863	1.81^{NS}
Error	22	9.1061	0.41391	
Total	35	15.0022		

NS = Non-Significant

B. Comparison of treatments' means

Topping (T) / Nitrogen rate (N)	T_0 = Control (No Topping)	T_1 = Topping at 90 cm height	T_2 = Topping at 120 cm height	T_3 = Topping at 150 cm height	Means
N_1 = 150 kg ha^{-1}	7.35	7.33	7.42	6.95	7.26
N_2 = 200 kg ha^{-1}	6.67	7.2	7.43	8.32	7.4
N_3 = 250 kg ha^{-1}	7.13	7.75	6.95	7.37	7.3
Means	7.05	7.43	7.27	7.54	

Ginning out turn (GOT) %

Effect of nitrogen rate was significant but effect of topping and their interactive effect was non-significant on ginning out turn (table 7). At 250 kg N ha^{-1} maximum ginning out turn (41.60%) was recorded which was at par with ginning out turn(40.59%) at 200 kg N ha^{-1} while minimum ginning out turn (39.56%) was recorded at 150 kg N ha^{-1} which was also at par with ginning out turn (40.59%) at 200 kg N ha^{-1}. It shows that as we increased nitrogen rate ginning out turn also increased which means lint percentage increased (seed percentage decreased).GOT was significantly affected by nitrogen application (Saleem*et al*., 2010).

Table-7: Effect of topping under different nitrogen levels onpercent ginning out turn (GOT) in cotton

A. Analysis of variance

SOV	DF	SS	MS	F Value
Replication	2	6.453	3.2267	
Nitrogen rate (N)	2	25.124	12.5622	4.02*
Topping (T)	3	1.619	0.5398	0.17^{NS}
N x T	6	24.985	4.1642	1.33^{NS}
Error	22	68.798	3.1272	
Total	35	126.981		

* = Significant NS = Non-Significant

A. Comparison of treatments' means

Topping (T) / Nitrogen rate (N)	T_0 = Control (No Topping)	T_1 = Topping at 90 cm height	T_2 = Topping at 120 cm height	T_3 = Topping at 150 cm height	Means
N_1 = 150 kg ha^{-1}	39.29	39.0	40.26	39.69	39.56 B
N_2 = 200 kg ha^{-1}	42.18	41.39	39.97	38.83	40.59 AB

N_3 = 250 kg ha^{-1}	40.84	42.0	41.28	42.3	41.60 A
Means	40.77	40.79	40.51	40.27	

Means not sharing a letter in common differ significantly at 5% probability.
Tukey's HSD value (5%) for Nitrogen means = 1.814

CONCLUSION:

There were significant effects of nitrogen rates and topping levels on cotton earliness and seed cotton yield. Overall it was concluded that topping at 120 cm height with the application of nitrogen at 200 kg ha^{-1} was most beneficial to get good seed cotton yield.

AUTHOR CONTRIBUTIONS:

All authors contributed equally.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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