

# Response of Lawn Grass Cultivars to Various Nitrogen Levels



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## Abstract

A study entitled "Response of lawn grass cultivars to various nitrogen levels" was conducted at Cantonment Board Nursery Nowshera Cant. Khyber Pakhtunkhwa. The experiment was laid out in Randomized Complete Block Design with two factors factorial arrangement and replicated three times. Three cultivars of lawn grass (Korean grass, Australian grass, and Fine Dhaka grass) were subjected to various levels (control, 50kg ha<sup>-1</sup>, 100kg ha<sup>-1</sup>, and 150kg ha<sup>-1</sup>) of nitrogen. Urea was used as a source of nitrogen. According to the result, the application of nitrogen to different grass cultivars significantly influenced all parameters except quantity of newly emerged leaves and days to new growth. Nitrogen applied at the rate of 150kg ha<sup>-1</sup> to Fine Dhaka grass resulted in maximum length of leaves (7.3cm), shoot length (30.2cm), and visual appearance (7.4) marks but significantly reduced the days to spread (46) days. Maximum number of leaves (2008.9), internodes length (2.85), and days to spread (129.9), were observed in Korean grass at control. Fine Dhaka grass gave minimum days to new growth (12.175). From the obtained results, it is concluded that nitrogen applied at 150kg ha<sup>-1</sup> to Fine Dhaka grass caused significant increase in leaf length, shoot length, and visual attraction judgment but resulted in significant decrease in days to spread.

**Keywords:** Nitrogen; Korean grass; Australian grass; Fine Dhaka grass; RCBD

## Introduction

The term lawn refers to a natural land of grass without hardwood perennial plants, while the term turf uses for all those grass lands which are neither cared, nor moved regularly [1]. Generally, lawn improves the appearance of space and makes the ground fit for games and other routine activities [2].

The beauty of any landscape is primarily due to the green lawn with planned materials. It greatly improves the value of homes and property. It serves as a source of comfort and gives a pride to owner (Alex and Vector, 1950). Principally lawns are used to protect the house from mud and dust, and an opportunity for recreation. Additionally, lawns are used to protect the home from heat and soften glare [3].

Bermuda grass botanically known as *Cynodon dactylon* belongs to family Poaceae. It is originated from subtropical area like east Africa and Asia [4]. It is also known as Devil's grass, Indian doab, Durva grass, Dog's tooth grass, Dhoob, Couch grass and Dubo. The blades are not wide, usually 2-15cm long without soft edges. The erect stems are slightly flat, has tinged purple color. The erect stems can grow 1-30cm tall. Bermuda grass is spread through runners and rhizomes. It can tolerate drought and grow rapidly on any type of soil except poor drain soil. It is hard and requires less water for fast growing. It is highly adapted

grass on hot humid regions due to low water consumption. It can tolerate heat. Growth is promoted by full sun and retarded close to tree trunks [1]. Cultivar texture ranges from course to fine such as common Bermuda to fine Dhaka grass. The Giant NK37, Alicia, Grazer, Brazes, Russell, Hill farm, Coastcross-1, Callie, Tifton 44, Tifton 68, Tifton 85, Tifton 78, Midland, Coastal and World feeder are the varieties of Bermuda grass [5]. American grass, Australian grass, Kabbal, Dhaka grass, and Fine Dhaka grass are cultivars of Bermuda grass [4].

Korean lawn grass botanically named as *Zoysia japonica* and belongs to the family Poaceae [4]. It is native to Japan, Indonesia southern Southern China Malaysia and Thailand. It is also known as ornamental grass, Japanese carpet, Manila, Temple grass and Siglap grass. The stems are prostrate and slender. The length of stem ranges from 5-25cm. The leaves are narrow, 1-3mm broad and 2-10cm long. It spread through suckers. It produces very dense lawn in humid and shaded area and grows well in light shade. In addition, it has ability to grow on sandy soils as well as in high salinity soil. It is also using for control of soil erosion and ideal for lawns in coastal areas. Korean grass needs more water than Bermuda grass. It also grows well on heavy soil. Warm season grasses do not tolerate cold and frost except Korean grass. Their straw color during winter dormancy is more active than

other grasses. Meyer zoysia grass Z-52, El Taro, Empire zoysia, Empress zoysia, J-36, Zeon and Zenith are the major cultivars of Korean grass [6].

Nitrogen is discovered by Danial Rutherford in 1772. Nitrogen is considered the seventh most abundant elements in the solar system and in the universe. Nitrogen is an essential building block of proteins, essential to living thing on earth. Nitrogen is part of protein, vitamins, chlorophyll, enzymes and other plants substances. The nitrogen stimulates chlorophyll in plants, enhances the process of photosynthesis. Development and growth of all turf grasses are positive correlates with nitrogen application and leaf nitrogen content. In addition, leaf area, number of leaves, length of leaves, stolon diameter, number of stolon and quality of grass improved by nitrogen application [7]. Protein contents enhanced with increase of nitrogen, which is related to quality of grasses. Deficiency of nitrogen is due to volatilization, leaching, immobilization and ammonium fixation. Overdoses of nitrogen delay the maturity, weaken the stems and increase susceptibility to disease (Vicente et al., 1956). When the conditions are good for plant then there is no need of nitrogen to be applied. In the next season plant use available nitrogen stored in the plant as during dry season much of the fertilizer nitrogen remains for the following year [8]. Optimum application of nitrogen in winter produces greenery in dry lawn and provides winter stress tolerance [9]. Nitrogen supply enhances vegetative growth, but greatest effect produced by late nitrogen application [10]. One of the distinguishing traits between poor maintained lawn and a well-cared lawn is the intensity of green color. The green color of lawn is associated with nitrogen contents of the soil and applied nitrogen. Darkness of green color increased with the enhanced nitrogen application. A deep green color of grass indicates that it has maximum nitrogen with balance amount of other essential elements. A balance fertilizer is necessary to keep the lawn healthy, green and active. Balance fertilization makes the lawn beautiful and gives aesthetic value to functional lawn (Tiefeng, 2010).

Occasionally Kentucky blue grass lawns suffer from attacks of fungi usually due to over fertilization with nitrogen fertilizer and over irrigation during hot humid weather [11].

### Review of Literature

Research work regarding the influence of nitrogen on various grass cultivars is reviewed as under:

Hanna et al. [12] explained in Forage grass species about varieties and history of Bermuda grass. Bermuda grass originated from Asia. Australian, Dhaka, Fine Dhaka grasses are the derivative of common Bermuda grass. Yan and Mingying (2010) described comparison of comprehensive characters of four mixed turfs in Shenyang. The two mixed sowing combinations were best with good performance of coverage, homogeneity, over summering rate, density, disease resistance and heat resistance. *Poa pratensis* and *Lolium perenne* showed best performance according to all attributes while other performed poorly.

Riaz et al. [4] worked on the morphological and biological response of turf grasses to lower nitrogen supply and in water deficit conditions. They conducted an experiment to know the biochemical responses and morphological of Bermuda grass cultivars Dhaka, khabbal, Fine Dhaka in water deficiency. They observed over all turf quality of all cultivars i.e. number of leaves, length of leaf, vegetative growth, plant height, number of roots and root length depressed with the increase of drought stress but khabbal performed better than other two grass cultivars for all these studied parameters.

Moore [1] explained sustainable turf grass management in Golf Club in Beijing Asia. He demonstrated the botany and habitat of Bermuda grass. It covered the spaced by means of both surface runners and rhizomes. It has ability to tolerate highly drought and grow rapidly on any type of soil except where drainage is poor. It was tough and hard grass requires less water for fast growing. It was mostly used in golf green ground in the region of hot humid due to low water consumption and abilities of high heat tolerance.

Borton et al. [9] observed nitrogen increases evapotranspiration of warm season turf grass. They mentioned in his research that nitrogen increases evapotranspiration and growth of a warm season turf grass. The effect of nitrogen fertilizer rate on kikuyu turf grass *pennisetum clandestinum* was enhanced for two summers. Three levels of treatment were used are 0, 50, 150kgNha<sup>-1</sup>yr<sup>-1</sup>. The younger turf grass used less nitrogen than older turf grass in both summer while evapotranspiration increased with the increased of nitrogen application rate in both the cases. Evapotranspiration was positive correlated with transpiring leaf area and turf grass growth.

Simon & Lemaire [13] indicated the influence of nitrogen, light and seedling densities on tillering and leaf area index during sward establishment of Italian ryegrass and perennial ryegrass in winter. The result showed that light and nitrogen played direct role on morphogenesis. When plants captured direct light with proper nitrogen application number of stolons increased. Andreas et al. [14] reported nitrogen stress influenced on the assimilated and remobilized nitrogen for leaf growth of a grass. Nitrogen deficiency reduced the leaf elongation rates and decreased nitrogen import into the growth zone.

David et al. [15] studied the effect of dissolved nitrogen in grass land soil. The result indicated that the conversion of insoluble nitrogen to dissolved organic nitrogen is considered as major steps to nitrogen supply. Nitrogen is movable elements. Plants uptake dissolved nitrogen. Nitrogen in urea quickly soluble in water than DAP.

Lue et al. [10] described the interaction of nitrogen and sulfur influenced on quality parameters of plants in New Zealand. During the growing season nitrogen and sulfur applied early and late separately. All the vegetative parameters increased by nitrogen application. Greatest effect produces by late nitrogen application while late sulfur application is not necessary for

best vegetative growth. Johannes & Kurt [16] reported effect of nitrogen on specific leaf area of dominant perennial grass species in Minnesota. Every species has specific leaf area and enhanced with increasing of nitrogen application. This specific leaf area enhanced the above ground competition for food, light and water along nitrogen gradients.

Evans [17] explained the relation between photosynthesis and nitrogen in leaves of C3 plant. Capacity of leaves photosynthesis is depending on the proteins of the thylakoids and calvin cycle, it indicates most of the leaf nitrogen. During seed formation most of the photosynthate is utilized and very little amount of nitrogen is uptake from the soil because at that time plants utilized store nitrogen. White (1987) reported that monthly nitrogen application at 1lb 1000ft<sup>-2</sup> to Bermuda grass was important for maintaining green cover during the autumn. When the Bermuda grass is reached to 4-6 inches then 2, 4-D was used to controlled tall broad leaf, some annual grasses and crabgrass were not controlled with 2, 4-D. Crabgrass, crowfoot grass and goose grass are best controlled by Diuron application and provide residual control for certain broadleaf weeds. After sprigging before weeds emerge Diuron should be applied immediately.

Prine & Glenn [18] demonstrated the effect of clipping frequency and nitrogen rate upon the certain morphological characteristics of coastal Bermuda grass. They reported in Bermuda grass stem length, internodes length, internodes number, protein percentage, leaf length, number of leaves enhanced with the increased of nitrogen while nitrogen recovery during formation of reproductive organs and seed head frequency reduced with the enhanced of nitrogen rates. More mowing, short interval between clipping and nitrogen supply during growing season enhanced vegetative growth while seed head frequency decreased. If interval between clippings increased 2 to 8 weeks, it would show high seed head frequency.

## Materials and Methods

The experiment entitled "response of different lawn grass cultivars to various nitrogen levels under climatic conditions of Nowshera" was conducted at Cantonment Board Garden Branch, Nowshera Cantt during the year 2015

### Experimental design and field preparation

The experiment was laid out in Randomized Complete Block Design (RCBD) with two factors factorial arrangement having three replications. Nitrogen levels and grass cultivars were used as factors. Nitrogen was applied at various levels such as control, 50kg ha<sup>-1</sup>, 100kg ha<sup>-1</sup>, and 150kg ha<sup>-1</sup>. Urea was used as a source of nitrogen. Different grass cultivars used such as Fine Dhaka grass, Australian grass and Korean grass in the experimental work. Total area under experiment was 13 x 4m<sup>2</sup>, whereas plot was 1 x 1m<sup>2</sup>.

#### Factor A: Nitrogen Levels

Control

50kg ha<sup>-1</sup>

100kg ha<sup>-1</sup>

150kg ha<sup>-1</sup>

#### Factor B: Grass cultivars

Korean grass

Australian grass

Fine Dhaka grass

The field was thoroughly ploughed with chisel plough. All the remaining plants, weeds, roots debris and any other inert materials were removed manually. The field was again thoroughly ploughed with disc plough and heavily irrigated and after a week, the remaining emerged weeds were sprayed with Roundup (Glyphosate) herbicide to ensure weed free field. The roundup (250ml) herbicide is dissolved in 10 liter of water and applied. This herbicide burned the weeds from top of the biomass to base of the root. After 2-3 weeks of herbicide application ploughed the field again and leveled. At the end, put the cleaned silt in plots. Plots were formed in each replication and sods of grasses were planted at 10cm plant to plant distance.

#### Management practices

Management practices such as irrigation, cleaning etc. were carried out when needed. The field was irrigated daily for the first two weeks and then on alternate day for the next two weeks. The frequency of irrigation was reduced after grass root establishment.

#### Parameters studied

Data were recorded on the following parameters:

##### Days to new growth

It was taken by counting the number of days from transplanting the sod into the field up to new growth started from six randomly sods of each plot.

##### Leaf length (cm)

Leaf length was measured with the help of a measuring tape from base to tip of leaves of six randomly selected leaves in each plot and average was calculated.

##### Number of leaves

The data was taken by counting the number of leaves per 10cm<sup>2</sup> at selected six different places randomly in each plot.

##### Internodes length (cm)

It was also measured with the help of measuring tape between two consecutive nodes then average was determined.

##### Shoot length (cm)

Shoot length was measured from soil line to the tip of six randomly selected plants, then average was calculated.

### Days to spread

Days to spread were worked out in terms of days to cover the 5cm space in each plot, and averages were calculated.

### Visual appearance

This data was submitted by five judges and the data was recorded based on their views on the growth, spread and visual appearance of grass.

## Result and Discussion

The research work on the “response of different lawn grass cultivars to various nitrogen levels under climatic conditions of Nowshera” was conducted at Cantonment Board Garden Branch Nowshera Cantt during year 2015. Data recorded on all parameter are presented in Table. The recorded results of all the study parameters are presented with brief discussion in the following paragraphs.

### Days taken to new growth

The data in table 1 shows the mean values of days taken to new growth and table 2 displays analysis of variance (ANOVA) of days taken to new growth. The statistical analysis (ANOVA) showed that nitrogen and its interaction with cultivars has no significant effect on days taken to new growth, while the cultivars significantly influenced the days taken to new growth.

**Table 1:** The effect of various nitrogen levels over different grass cultivars on days to new growth.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars			
	Korean	Australian	Fine Dhaka	
Control	24.2 a	14.9 b	12.3 c	17
50	24.1 a	15.1 b	12.1 c	1
100	24.1 a	15.1 b	12.1 c	1
150	24.1 a	15.1 b	12.2 c	17
Mean	24.125 a	15.05 b	12.175 c	

LSD value at 5% level of probability for N=0.2101 V=0.1820 and N\*V=0.3639.

**Table 2:** Analysis of variance of days to new growth as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	0.017	0.009		
N	3	0.021	0.007	0.15	0.9284
V	2	934.109	467.054	10112.3	0
N x V	6	0.187	0.031	0.67	0.6721
Error	22	1.016	0.046		
Total	35	935.35			

The mean values show that cultivars maximum number of days taken to new growth (24.125) was taken by Korean grass, followed by Australian grass (15.05), whereas minimum number of days to new growth (12.175) was observed for Fine Dhaka grass.

After shifting sods, nitrogen had no effect on days taken to new growth. The possible reason may be the fact that grasses use stored nitrogen for following new growth activities. In juvenile period plant store, most of the available nitrogen in stem. It might be the reason nitrogen has no effect on seedling [19]. These results also correlate with Rauf [20] findings that in grasses before the maturation most of photosynthate is used for growth.

The data in table 3 shows the average values of leaf length and table 4 displays analysis of variance (ANOVA) of leaf length. The statistical analysis (ANOVA) showed that nitrogen and cultivars significantly influenced the leaf length, and the nitrogen interaction with cultivars has also significant effect on leaf length.

**Table 3:** The effect of various nitrogen levels over different grass cultivars on leaf length.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars		
	Korean	Australian	Fine Dhaka
Control	4.8 a	6.4 b	6.5 c
50	5.1 a	6.5 b	6.8 c
100	5.3 a	6.8 b	7.1 c
150	5.7 a	7.2 b	7.3 c
Mean	5.225 a	6.725 b	6.925 c

LSD value at 5% level of probability for N=0.1258, V=0.1090, and N\*V=0.2179.

Means followed by different letters are significantly different using LSD test at 5% significance level.

**Table 4:** Analysis of variance of leaf length as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	0.0422	0.0211		
N	3	3.6511	1.217	73.47	0
V	2	21.0206	10.5103	634.46	0
N x V	6	0.1039	0.0173	1.05	0.4238
Error	22	0.3644	0.0166		
Total	35	25.1822			

The average values show that maximum leaf length (6.73cm) was recorded with 150kg N ha<sup>-1</sup> while minimum (5.9cm) was observed in control. In Cultivars the highest leaf length (6.925cm) was observed in Fine Dhaka grass, whereas lowest leaf length (5.225cm) was observed in Korean grass.

Nitrogen levels affected leaf length maximum (6.73cm) leaf length was observed with the application of 150kg N ha<sup>-1</sup> and minimum (5.9m) was obtained at control. The obvious reason might be that nitrogen plays significant role in plant growth and development. All the morphological and quality structure of grasses is reduced with low availability of nitrogen and irregular irrigation. Nitrogen enhances vegetative growth of plants. Similar observations were also stated by [9]. Cultivars influenced maximum leaf length (6.925) was observed in Fine Dhaka grass and minimum leaf length (5.225cm) was shown by Korean

grass. The obvious reason might be that the shape of the leaf is produced by the magnitude and direction of periclinal division and anticlinal division. Width of leaf blade of grasses cease before leaf mature while basal meristem remains active for long period after leaf maturity.

### Number of leaves

The data in table 5 shows the mean values of number of leaves and table 6 displays analysis of variance (ANOVA) of number of leaves. The statistical analysis (ANOVA) showed that nitrogen and its interaction with cultivars has significant effect on number of leaves, and the cultivars also significantly influenced the number of leaves.

**Table 5:** The effect of various nitrogen levels over different grass cultivars on number of leaves.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars			
	Korean	Australian	FineDhaka	Mean
Control	2004 a	1418 b	890.3 c	1437.433
50	2005 a	1482.9 b	895.9 c	1461.267
100	2012.3 a	1488.9 b	904.3 c	1468.5
150	2014.3 a	1494.9 b	913 c	1474.067
Mean	2008.9 a	1471.175 b	900.875 c	

LSD value at 5% level of probability for N=3.0622, V=2.6519, and N\*V=5.3038.

Means followed by different letters are significantly different using LSD test at 5% significance level.

**Table 6:** Analysis of variance of days to number of leaves as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	11	5		
N	3	1356	452	46.07	0
V	2	7374432	3687216	375835	0
N x V	6	129	21	2.19	0.0829
Error	22	216	10		
Total	35	7376144			

According to Table maximum number of leaves (1474.067) was recorded with 150kg N ha<sup>-1</sup> at 10cm<sup>2</sup> area, while minimum number of leaves (1437.433) was observed in control. Cultivars showed more effect about the number of leaves. Table values for different cultivars showed that maximum number of leaves (2008.9) was noted in Korean grass, whereas minimum (900.875) was observed in Fine Dhaka grass.

The interaction between nitrogen levels and cultivars showed more effect on number of leaves. Maximum number of leaves (2014.3) was noted in Korean grass treated with 150kg N ha<sup>-1</sup>, while lowest value for length of leaves (890.3) was recorded in Fine Dhaka grass in control treatment.

From the table, it justifies that nitrogen plays crucial role on number of leaves maximum (1474.067) number leaves with 150kg

N ha<sup>-1</sup> treatment while minimum (1437.433) number of leaves at control. This may be due to fact that in juvenile period plant uptake more nitrogen from soil and use most of the photosynthate for vegetative growth. Current findings also obtained by Rene & Mensink [21] that the phenotypic response in various vegetative parameters of grasses to nitrogen supply is more effective. This statement was also justified by Rauf [20] that young plant utilized more than half of photosynthate assimilation for growth. Before the formation of flower plant store most of the available nitrogen in vegetative parts and resulting increases number of leaves per plant. Table 7 further shows that cultivars has significant effect on number of leaves maximum number of leaves (2008.9) was exposed by Korean grass while minimum (900.875) indicated in Fine Dhaka grass. It may be the reason that Korean grass grows slowly as compared to Fine Dhaka grass, it used less nitrogen but for long time. This reason might be considered for maximum number leaves. Same results were discovered by Ryser & Hans [22] that leaf area, leaf length, number of leaves and height of grasses is led to enhance biomass of grasses. Biomass of slow grows grasses required less nitrogen for long term is advantage under nutrient poor condition.

**Table 7:** The effect of various nitrogen levels over different grass cultivars on internodes length.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars			
	Korean	Australian	Fine Dhaka	Mean
Control	2.3 a	2.2 b	2.3 c	2.266667
50	2.3 a	2.2 b	2.3 c	2.266667
100	2.9 a	2.8 b	2.9 c	2.866667
150	3.9 a	3.1 b	3.5 c	3.5
Mean	2.85 a	2.575 b	2.75 c	

### Internodes length (cm)

The data in table 7 shows the mean values of internodes length and table 8 displays analysis of variance (ANOVA) of internodes length. The statistical analysis (ANOVA) showed that nitrogen and its interaction with cultivars has significant effect on internodes length, and the cultivars also significantly influenced the internodes length.

**Table 8:** Analysis of variance of internodes length as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	0.04056	0.02028		
N	3	8.74	2.91333	344.38	0
V	2	0.26056	0.13028	15.4	0.0001
N x V	6	0.58167	0.09694	11.46	0
Error	22	0.18611	0.00846		
Total	35	9.80889			

Table 7 show that highest internodes length (3.5cm) was noted in grass supplied with 150kg N ha<sup>-1</sup> which is followed by (2.86cm) with 100kg N ha<sup>-1</sup> and (2.26cm) at 50kg N ha<sup>-1</sup> treatment, while

minimum (2.26cm) was observed in control. Cultivars showed maximum internodes length (2.85cm) was observed in Korean grass, whereas minimum (2.575cm) was showed by Australian grass.

From the data recorded on internodes length, it is obvious that internodes length was maximum (3.5cm) at the application of 150kg N ha<sup>-1</sup> and minimum (2.26cm) in control. This might be reason that before flowering most of the nitrogen moves toward internodes. Such finding also described by [4] that Nitrogen has crucial role on internodes length. Internodes length, leaf area and height of plant associated with nitrogen availability.

Root and shoot ratio also depend on nitrogen availability. In grasses much of the nitrogen are mobile in the phloem then move into internodes before seed production available for next season growth.

### Shoot length (cm)

The data in table 9 shows the mean values of shoot length and table 10 displays analysis of variance (ANOVA) of shoot length. The statistical analysis (ANOVA) showed that nitrogen and its interaction with cultivars has significant effect on shoot length, and the cultivars also significantly influenced the shoot length.

**Table 9:** The effect of various nitrogen levels over different grass cultivars on shoot length.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars			
	Korean	Australian	Fine Dhaka	Mean
Control	8.5 a	16.4 b	26.8 c	17.23333
50	8.5 a	14.4 b	26.9 c	16.6
100	13 a	20 b	29.9 c	20.96667
150	13.4 a	21.9 b	30.2 c	21.83333
Mean	10.85 a	18.175 b	28.45 c	

LSD value at 5% level of probability for N=0.0855, V=0.0741, and N\*P=0.1481.

Means followed by different letters are significantly different using LSD test at 5% significance level.

**Table 10:** Analysis of variance of shoot length as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	0.03	0.016		
N	3	158.92	52.974	6923.38	0
V	2	1869.3	934.651	122152	0
N x V	6	6.54	1.09	142.52	0
Error	22	0.17	0.008		
Total	35	2034.97			

According to Table 9 maximum shoot length (21.83cm) was recorded with 150kg N ha<sup>-1</sup>, while minimum (16.6cm) was observed in 50 kg N ha<sup>-1</sup>. Cultivars displayed high effect about the shoot length. Cultivars exposed that maximum shoot length

(18.45cm) was indicated by Fine Dhaka grass, whereas minimum (10.85cm) was observed in Korean grass.

The obvious reason might be that meristematic tissue of shoot has a very active protein metabolism; nitrogen is also a part of amino acid. Most of the nitrogen translocated to the stem and shoot before the seed production. Related results were also found by [19] that before seed production more than half of the photosynthate transported to leaves and stem for vegetative growth, therefore nitrogen has significant effect on shoot length and clipping. Similar results were also described by [4].

### Days to spread

The data in table 11 shows the mean values of days to spread and table 12 displays analysis of variance (ANOVA) of days to spread. The statistical analysis (ANOVA) showed that nitrogen and its interaction with cultivars has significant effect on days to spread, and the cultivars also significantly influenced the days to spread. Table 11 shows that highest value for days to spread in (79.9) days was recorded in control which is followed by (74.43) at 150kg N ha<sup>-1</sup> and (73.7) at 50kg N ha<sup>-1</sup> treatment, while minimum (67.26) was observed in 100 kg N ha<sup>-1</sup> treatment. Cultivars presented significant effect about the days to spread. Cultivars indicated that maximum days to spread in (119.95) days was observed in Korean grass, whereas minimum (45.675) was showed by Fine Dhaka grass.

**Table 11:** The effect of various nitrogen levels over different grass cultivars on days to spread.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars			
	Korean	Australian	Fine Dhaka	Mean
Control	129.9 a	59.9 b	49.9 c	79.9
50	117.9 a	56.3 b	46.9 c	73.7
100	112 a	49.9 b	39.9 c	67.26667
150	120 a	57.3 b	46 c	74.43333
Mean	119.95 a	55.85 b	45.675 c	

LSD value at 5% level of probability for N=0.3670, V=0.3179, and N\*V=0.6357.

Means followed by different letters are significantly different using LSD test at 5% significance level.

**Table 12:** Analysis of variance of days to spread as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	0.3	0.1		
N	3	725.8	241.9	1716.22	0
V	2	38895.1	19447.6	137965	0
N x V	6	97.6	16.3	115.34	0
Error	22	3.1	0.1		
Total	35		39721.8		

Same results were discovered by Rauf [20] Grass coverage rate increased with increased of nitrogen supply. Fine Dhaka grass spread in approximately 45 to 50 days with proper nitrogen

supply while Korean grass in 120 days. The interaction between nitrogen and cultivars has vital role on grass spread, Fine Dhaka

grass taken minimum (46) days to spread with the dose of 150kg N ha<sup>-1</sup>. Related results were also found by Zafrullah (1989) that grass coverage rate depends on light, temperature, grass cultivars and nitrogen supply. Korean grass spread through suckers, so coverage rate is so slow because of upward growth.

### Visual appearance

The data in table 13 shows the mean values of visual appearance and table 14 displays analysis of variance (ANOVA) of visual appearance. The statistical analysis (ANOVA) showed that nitrogen and its interaction with cultivars has significant effect on visual appearance, and the cultivars significantly influenced the visual appearance.

**Table 13:** The effect of various nitrogen levels over different grass cultivars on visual appearance.

Nitrogen Level (Kg ha <sup>-1</sup> )	Grass Cultivars			
	Korean	Australian	Fine Dhaka	Mean
Control	4.7 a	6.4 b	6.4 c	5.833333
50	5.2 a	6.5 b	6.7 c	6.133333
100	5.3 a	6.9 b	7.1 c	6.433333
150	5.9 a	7.1 b	7.4 c	6.8
Mean	5.275 a	6.725 b	6.9 c	

LSD value at 5% level of probability for N=0.1121, V=0.0971, and N\*P=0.1942.

Means followed by different letters are significantly different using LSD test at 5% significance level.

**Table 14:** Analysis of variance of visual appearance as affected by various levels of nitrogen.

Source	DF	SS	MS	F	P
Rep	2	0.0706	0.03528		
N	3	4.5897	1.52991	116.28	0
V	2	19.01	9.50528	722.47	0
N x V	6	0.2628	0.0438	3.33	0.0174
Error	22	0.2894	0.01316		
Total	35	24.2231			

Table 13 expresses that highest value for visual appearance (6.8) number was noted in 150kg N ha<sup>-1</sup> treatment, while minimum (5.83) number was observed in control. Cultivars showed significant effect about the visual appearance. Mean values for cultivars showed that maximum visual appearance (6.9) numbers was observed in Fine Dhaka grass, whereas minimum (5.275) numbers was showed by Korean grass.

From the review of table 14 interaction nitrogen and cultivars had significant effect on visual judgments. Highest number for visual appearance (7.4) was noted in Fine Dhaka grass with the application of 150kg N ha<sup>-1</sup> and lowest number of visual appearance (4.7) was exposed by Korean grass in control. Alike results were found by Rauf, (1992) that visual judgment is observed by 5

judges. Grade is given according to good performance like growth, coverage rate, visual appearance, softness, care and maintenance [23-39].

### Summary and Recommendations

Experiment on response of different lawn grass cultivars to various nitrogen levels under climatic conditions of Nowshera was conducted at Cantonment Board Garden Branch Nowshera Cantt during year 2015.

The experiment was laid out in Randomized Complete Block Design with two factors factorial arrangements and replicated three times. Nitrogen was used as 0, 50kg ha<sup>-1</sup>, 100kg ha<sup>-1</sup>, and 150kg ha<sup>-1</sup>. Urea is a source of nitrogen and grass cultivars such as Korean grass, Australian grass, Fine Dhaka grass were used.

The application of nitrogen significantly influenced all the studied parameters except emergence of new leaves. Nitrogen applied at the rate of 150kg ha<sup>-1</sup> to the Fine Dhaka grass resulted in highest leaf length (7.5cm), shoot length (30.2cm), and visual appearance (7.4) but it significantly reduced days to spread (45).

Maximum days to grass spread (119.95) were observed in Korean grass in control, while number of leaves (2008.9) per 10cm<sup>2</sup>, internodes length (2.85cm) and were found in Korean grass supplied with 150kg ha<sup>-1</sup>. Fine Dhaka grass took minimum days to new growth (12.1) where it seems that nitrogen had no significant effect on new growth.

### Conclusion

Based on current findings following conclusions can be drawn

- 150kg ha<sup>-1</sup> nitrogen applied to Fine Dhaka grass caused significant increase in leaf length, shoot length and visual appearance but simultaneously decreases days to spread.
- Nitrogen fertilizer applied at the rate of 150kg ha<sup>-1</sup> to Korean grass gave good results regarding number of leaves, internodes length.

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