Journal of Crop Nutrition Science
ISSN: 2423-7353 (Print) 2538-2470 (Online)
Vol. 5, No. 2, 2019
http://JCNS.iauahvaz.ac.ir
OPEN ACCESS

Response of Fresh Forage, Dry Matter and Yield Components of Sorghum to Different level of Nitrogen and Cutting Height

Zahra Gholiporkahyash[1,2], Mojtaba Alavifazel[2]*, Mohammad Reza Dadnia[2]

1- *MSc. Graduated, Department of Agronomy, Khuzestan Science and Research Branch, Islamic Azad University, Ahvaz, Iran.*

2- *Department of Agronomy, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran.*

RESEARCH ARTICLE

ARTICLE INFO.
Received Date: *31 Mar. 2019*
Received in revised form: *6 May. 2019*
Accepted Date: *10 Jun. 2019*
Available online: *30 Jun. 2019*

To Cite This Article:
Zahra Gholiporkahyash, Mojtaba Alavifazel, Mohammad Reza Dadnia. Response of Fresh Forage, Dry Matter and Yield Components of Sorghum to Different level of Nitrogen and Cutting Height. ***J. Crop. Nutr. Sci.,*** 5(2): 57-67, 2019.

ABSTRACT

BACKGROUND: Fertilizer management plays an important role for obtaining satisfactory yields and to increase crop productivity. Nitrogen is generally a limiting nutrient in crop production, and especially in sorghum, as it has been said to be the most responsive nutrient for its production.

OBJECTIVES: Current study was conducted to assessment effect of urea fertilizer and cutting height on seed yield, its components and harvest index of Sorghum.

METHODS: This research was carried out via split plot experiment based on randomized complete blocks design with three replications. The main factor included three level of urea fertilizer (200, 300 and 400 $kg.ha^{-1}$) and three level of cutting height (7, 12 and 14 cm) belonged to subfactor.

RESULT: According result of analysis of variance effect of urea fertilizer and cutting height on all measured traits (instead harvest index) was significant, but interaction effect of treatments on 1000-seed weight, fresh forage yield, harvest index, number of seed per panicle and number of fertile tiller was not significant. Mean comparison result of different level of urea fertilizer indicated that maximum amount of all measured traits belonged to 400 $kg.ha^{-1}$ treatment. As for Duncan classification made with respect to different level of cutting height the highest amount of studied characteristics was for 7cm treatment. Evaluation mean comparison result of interaction effect of treatments revealed maximum seed yield (693 $gr.m^{-2}$) was noted for 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height and lowest one (480 $gr.m^{-2}$) belonged to 200 $kg.ha^{-1}$ urea and 17cm treatment. Similar result was found for other traits.

CONCLUSION: According result of current study 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height had the highest amount of studied traits, so it can be advice to producers.

KEYWORDS: *Crop production, Fertilizer, Nutrition, Seed weight, Urea*.

***Corresponding Author:** Mojtaba Alavifazel ✉ Mojtaba_alavifazel@yahoo.com

1. BACKGROUND

Forage crops play an important role in supplying energy and protein to livestock (Eskandari *et al*., 2009). In breeding of forage crops, increase of yield and forage quality are the main factors which play prominent role in the introduction of new varieties. Forages with good quality should have high dry matter yield, energy, digestibility and low fiber for optimal fermentation in the silo and storage. Sorghum is the fifth most important cereal crop grown for human consumption in the world being surpassed only by rice, wheat, barley and corn. Most of sorghum grown in Asia and the African tropics is used for human food and also fed to livestock or poultry (Gul *et al*., 2005). Sorghum is a drought resistant summer annual crop (Aishah *et al*., 2011). Sorghum speedfeed is a crop of world-wide importance and is unique in its ability to produce under a wide array of harsh environmental condition (Sadeghzade *et al*., 2012). Sorghum is grown as fodder crop due to the poor pollination and seed set during the extremely hot dry season (April-August) in the southeastern provinces of Iran-Sistan and Baluchistan. Applying superabsorbent polymers can increase the water-holding capacity of soils and reduce the harmful effects of short-term drought in drought-prone arable areas (Karimi and Naderi, 2007). Sorghum is the fourth most important cereal crop grown in the world. Sorghum is grown on approximately 44 million hectares in 99 countries. In Bangladesh, 254 tons of sorghum grains are produced annually from about 187 ha of land with an average of 1.36 tons per hectare (FAOSTAT, 2013). Sorghum has potential uses such as: food (grain), feed (grain and biomass), fuel (ethanol production), fiber (paper), fermentation (methane production) and fertilizer (utilization of organic byproducts) (Roy *et al*., 2018). Sorghum production in Iran has spanned almost 120 yr. The crop has served producers and end users well, as advancements in cultivar development have produced the high-performing, well adapted, premium quality cultivars. For example, screening of seven salinity tolerant and ten salinity sensitive sorghum genotypes was reported (Chuck and Donnelly, 2014). Crop management is important to attain higher stalk yield in sweet sorghum. Among the various inputs that improve the efficiency of a cultivar in realizing its potential, fertilizers (nitrogen in particular) play a crucial role. Nitrogen is generally a limiting nutrient in crop production, and especially in sorghum, as it has been said to be the most responsive nutrient for its production (Singh *et al*., 1972). Fertilizer management plays an important role for obtaining satisfactory yields and to increase crop productivity. Nutrient management may be achieved by the involvement of organic sources, bio fertilizers, and micro-nutrients (Singh *et al*., 2002). Among the macro nutrients essential for crop growth, nitrogen (N) is a very mobile element in the soil, due to its susceptibility to leaching, de nitrification, and volatilization losses. Excessive use of N fertilizer can lead to pollution of water bodies and may lead to soil acidification. Balanced and efficient use of applied N is of paramount importance in the overall nutrient management system than any other plant nutrient in order to reduce its negative impact on the environment. Besides, even under the best management practices, 30%-50% of the applied nitrogen is lost through different routes and hence more fertilizer needs to be applied than actually needed by the crop to compensate for the loss. The transitory loss of N not only causes loss to the farmer but also causes irreversible damage to the environment. High rates of chemical fertilizer cause environmental pollution (Shamme *et al.,* 2016). Current recommendations regarding cutting height of alfalfa are designed to maximize yield while maintaining high quality forages and stand longevity. Forage growers frequently cut forages at a height of three or more inches. However, recent reports indicate that there may be an advantage to cutting alfalfa closer, leaving an inch or less of stubble height (Agriculture Online, 1999). Obtaining higher yields requires that the plants are healthy and that carbohydrate root reserves are adequate for plant regrowth following harvest. Early Wisconsin studies using Vernal alfalfa showed that forages harvested three or four times per season produced more total forage when cut at a 1-inch height versus cutting at 3 inches or more (Smith and Nelson, 1967).

2. OBJECTIVES

Current study was conducted to assessment effect of urea fertilizer and cutting height on seed yield, its components and harvest index of Sorghum.

3. MATERIALS AND METHODS

3.1. Field and Treatments Information

This research was carried out to evaluate effect of nitrogen fertilizer and cutting height on crop production of Sorghum via split plot experiment based on randomized complete blocks design with three replications along 2012 year. Place of research was located in Ahvaz city at longitude 48°40'E and latitude 31°20'N in Khuzestan province (Southwest of Iran). The main factor included three level of urea fertilizer (200, 300 and 400 kg.ha^{-1}) and three level of cutting height (7, 12 and 14 cm) belonged to subfactor. This experiment had 27 plots. Physical and chemical properties of the studied soil were mentioned in table 1.

Table 1. Physical and chemical properties of studied field

Soil depth (cm)	Sand (%)	Silt (%)	Clay (%)	Soil texture	ρb (gr.cm^{-3})	Potassium (mg.kg^{-1})
0-30	12.5	41	46.5	Siltyclay	1.34	181
30-60	11.8	40	48.4	Siltyclay	1.36	125

Continue Table 1.

Soil depth (cm)	Phosphorus (mg.kg^{-1})	Nitrogen (mg.kg^{-1})	pH	Organic carbon (%)	EC (ds.m^{-1})
0-30	9.1	7	7.8	0.65	2.6
30-60	6.8	3	7.6	0.36	2.2

3.2. Farm Management

The required nitrogen was provided by the urea source. In order to prevent horizontal movement of urea fertilizer during the fertilization, some furrows were made in irrigation streams and the fertilizer was evenly placed in the furrows. Then they were covered by soil and immediately irrigated. While planting at the first stage, urea fertilizer was distributed to the experiment land as the basic fertilizer. Potassium fertilizer was not used due to high level of absorbable potassium. The required amounts of nitrogen fertilizers were identified after the soil analysis and the needed fertilizer for each plot was calculated with regard to the plot size and the levels of studied treatments and 25% of pure nitrogen as the base fertilizer was added to the land before planting and 75% was added at 8-leaf stage. There were 8 plots in each block. The space between each sub plot from the other one was as one non-planting line and the space between every two main plots was as two non-planting lines. There were 6 planting rows in each plot and the space between the rows was 75 cm and over the rows was 12 cm. Cultivar seeds were used. The seeds were planted at the end of July month as ridge and furrows at the depth of 3-4 cm. in seed mixing method, after blending the seeds they were dried in shadow and immediately planted. After sowing the seeds, the field was irrigated. During the growth stage, growing operations such as irrigation, thinning, crop nutrition, eradicate pests and controlling the weeds (at 4-leaf stage) were done.

3.3. Measured Traits

In order to determine the yield and its components two planting lines from each plot and after the removal of marginal effect were carried to the laboratory and were placed in the oven at 75°C for 48 hours and after ensuring that the samples were completely dry, they were weighed and finally the total yield was measured. Moreover, in order to determine the yield components such as the number of spikelet per spike, number of seeds per spikelet, number of seeds per spike, and 1000-seed weight, after selecting 10 plants from each plot their means were considered as the yield components. 1000-seed weight was measured after accurate sifting and cleaning of seeds and drying them in open air. Harvest index (HI) was calculated according to formula of Gardner *et al*. (1985) as follows: **Equ.1.** HI= (Seed yield/Biologic yield) ×100.

3.4. Statistical Analysis

Analysis of variance and mean comparisons were done via SAS (Ver.8) software and Duncan multiple range test at 5% probability level.

4. RESULT AND DISCUSSION

4.1. Seed yield

Yield is a complex trait resulting from interaction of morphological, physiological and environmental parameters on the growth of plants. Identification of variations of morphological and physiological traits influencing yield of a plant in a certain environment is essential tool for selecting and breeding of yield (Azarpour *et al*., 2014).

According result of analysis of variance effect of urea fertilizer, cutting height and interaction effect of treatments on seed yield was significant at 5% probability level (Table 2). Mean comparison result of different level of urea fertilizer indicated that maximum seed yield (594 $gr.m^{-2}$) was noted for 400 $kg.ha^{-1}$ urea and minimum of that (510 $gr.m^{-2}$) belonged to 200 $kg.ha^{-1}$ treatment (Table 3). As for Duncan classification made with respect to different level of cutting height maximum and minimum amount of seed yield belonged to 7cm (641 $gr.m^{-2}$) and 17cm (495 $gr.m^{-2}$) (Table 4). Evaluation mean comparison result of interaction effect of treatments indicated maximum seed yield (693 $gr.m^{-2}$) was noted for 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height and lowest one (480 $gr.m^{-2}$) belonged to 200 $kg.ha^{-1}$ urea and 17cm treatment (Table 5). Including ways to increase the yield per unit area can be mentioned to appropriate management in crops nutrition and intercropping systems plants. Increasing nitrogen fertilizer applications has been a major management strategy to obtain high yield (Guo *et al*., 2010). Several reports showed that sorghum had severed reaction to nitrogen fertility. Beyart and Roy (2005) studied nitrogen fertility on sorghum Sudan grass and reported that highest yield was produced by application 125 kg nitrogen per hectare.

4.2. 1000-Seed weight

Result of analysis of variance revealed effect of urea fertilizer and cutting height on 1000-seed weight was significant at 5% probability level, but interaction effect of treatments was not significant (Table 2). According result of mean comparison maximum of 1000-seed weight (27.27 gr) was obtained for 400 $kg.ha^{-1}$ urea fertilizer and minimum of that (23.59 gr) was for 200 $kg.ha^{-1}$ treatment (Table 3). Evaluation mean comparison result indicated in different level of cutting height the maximum 1000-Seed weight (28.89 gr) was noted for 7cm and minimum of that (24.53 gr) belonged to 17cm treatment (Table 4). Assessment mean comparison result of interaction effect of treatments indicated maximum 1000-Seed weight (30.65 gr) was noted for 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height and lowest one (21.94 gr) belonged to 200 $kg.ha^{-1}$ urea and 17cm treatment (Table 5). Biari *et al.* (2008) reported that in case of consumption of chemical and bio-fertilizers the seed weight of would increase which is consistent with present results.

4.3. Fresh forage yield

According result of analysis of variance effect of urea fertilizer and cutting height on fresh forage yield was significant at 5% probability level but interaction effect of treatments was not significant (Table 2). Assessment mean comparison result indicated in different level of urea fertilizer the maximum fresh forage yield (10158 $gr.m^{-2}$) was noted for 400 $kg.ha^{-1}$ and minimum of that (9684 $gr.m^{-2}$) belonged to 200 $kg.ha^{-1}$ treatment (Table 3). Compare different level of cutting height showed that the maximum and the minimum amount of fresh forage yield belonged to 7cm (10372 $gr.m^{-2}$) and 17cm (9607 $gr.m^{-2}$) treatments (Table 4).

Table 2. Result analysis of variance of measured traits

S.O.V	df	Seed yield	1000-Seed weight	Fresh forage yield	Dry matter yield	Harvest index
Replication	2	550.8^{ns}	6.18^{ns}	85422^{ns}	2119^{ns}	9.07^{ns}
Urea (U)	2	4979.2*	40.55*	321702*	27318*	166.05^{ns}
Error I	4	315.4	5.73	4019	105	9.99
Cutting height (C)	2	2762.2*	54.94*	46832*	41925*	12.02^{ns}
U × C	4	1821.3*	11.09^{ns}	221^{ns}	8361*	5.95^{ns}
Error II	12	541.4	3.14	1106	139	17.31
CV (%)	-	3.81	6.8	1.05	2.13	11.42

$^{ns, *\ and\ **}$: no significant, significant at 5% and 1% of probability level, respectively.

Continue Table 2.

S.O.V	df	Number of seed per panicle	Number of panicle shoots	Number of fertile tiller	Number of plant per m^{-2}
Replication		4002^{ns}	1.69^{ns}	0.129^{ns}	3.81^{ns}
Urea (U)		34732*	44.11**	0.884*	24.37*
Error I		840	0.96	0.059	1.48
Cutting height (C)		14830*	12.82**	1.628*	52.70*
U × C		1868^{ns}	9.31**	0.008^{ns}	15.54*
Error II		254	0.69	0.030	4.65
CV (%)		16.32	5.8	7.73	11.17

$^{ns, *\ and\ **}$: no significant, significant at 5% and 1% of probability level, respectively.

Evaluation mean comparison result of interaction effect of treatments indicated maximum fresh forage yield (10473 gr.m^{-2}) was noted for 400 kg.ha^{-1} urea fertilizer and 7cm cutting height and lowest one (9320 gr.m^{-2}) belonged to 200 kg.ha^{-1} urea and 17cm treatment (Table 5). In study conducted by Garg *et al.* (2005) increasing nitrogen to soil increased the plant photosynthetic efficiency and ultimately increased the seed yield and growth rate. On the other hand, since the rate of light absorption by leaves and converting it into photosynthetic materials are the other factors affecting the plant growth and production, the increase of leaf area in the farm leads to the increase of light absorption and ultimately leads to the increase of crop production.

4.4. Dry matter yield

Result of analysis of variance showed effect of urea fertilizer, cutting height and interaction effect of treatments on dry matter yield was significant at 5% probability level (Table 2). Evaluation mean comparison result revealed in different level of urea fertilizer the maximum dry matter yield (2496 gr.m^{-2}) was noted for 400 kg.ha^{-1} and minimum of that (2101 gr.m^{-2}) belonged to 200 kg.ha^{-1} treatment (Table 3). Between different levels of cutting height the maximum number of dry matter yield (2575 gr.m^{-2}) was observed in 7cm and the lowest one (2193 gr.m^{-2}) was found in 17cm treatment (Table 4). Assessment mean comparison result of interaction effect of treatments indicated maximum dry matter yield (2686 gr.m^{-2}) was noted for 400 kg.ha^{-1} urea fertilizer and 7cm cutting height and lowest one (1949 gr.m^{-2}) belonged to 200 kg.ha^{-1} urea and 17cm treatment (Table 5). Almodares *et al*. (2009) suggested to apply 200 kg.ha^{-1} urea because the highest biomass and protein content and the lowest fiber content will be achieved with at this amount of nitrogen fertilizer. Although, this amount of nitrogen will decreased soluble carbohydrates content but it seems this reduction dose not effect on forage palatability and digestibility considerably. Moghimi and Emam (2015) in order to evaluate the impact of different amounts of nitrogen fertilizer on yield of sorghum cultivars reported Pegah cultivar and application of 205 kg N ha^{-1} might be offered for producers (in similar climate). Nitrogen is an important nutrient for optimum crop growth and yield performance. Although its effect on the growth and yield of sweet sorghum has been demonstrated to be dependent on the factors of climate, soil type and genotype which also vary across seasons and locations, the application nitrogen generally results in increase in the biomass and yield of sweet sorghum until an optimum rate is reached. This optimum rate varies from one location to another and from one season to another. However, from this, the optimum rate can be said to lie within the range of 60 and 120 kg N ha^{-1} depending on the location, the soil type and the native N of the soil determined through soil test (Olugbemi, 2017).

Table 3. Mean comparison effect of different level of urea on measured traits

Urea (kg.ha^{-1})	Seed yield (gr.m^{-2})	1000-Seed weight (gr)	Fresh forage yield (gr.m^{-2})	Dry matter yield (gr.m^{-2})
200	510^{c}	23.59^{b}	9684^{b}	2101^{b}
300	549^{b}	27.10^{a}	9856^{ab}	2381^{a}
400	594^{a}	27.27^{a}	10158^{a}	2496^{a}

*Means with similar letters in each column are not significantly differentt by Duncan's test at 5% probability level.

Continue Table 3.

Urea (kg.ha^{-1})	Number of seed per panicle	Number of panicle shoots	Number of fertile tiller	Number of plant per m^{-2}
200	326^{b}	12.50^{b}	2.01^{b}	16.89^{b}
300	404^{ab}	15.30^{a}	2.09^{b}	19.67^{ab}
400	433^{a}	15.34^{a}	2.62^{a}	21.33^{a}

*Means with similar letters in each column are not significantly differentt by Duncan's test at 5% probability level.

4.5. Harvest index

According result of analysis of variance effect of urea fertilizer, cutting height and interaction effect of treatments on harvest index was not significant (Table 2).

4.6. Number of seed per panicle

According result of analysis of variance effect of urea fertilizer and cutting height on number of seed per panicle was significant at 5% probability level, but interaction effect of treatments was not significant (Table 2). Mean comparison result of different level of urea fertilizer indicated the maximum number of seed per panicle (433) was obtained for 400 kg.ha^{-1} and minimum of that (326) was for 200 kg.ha^{-1} treatment (Table 3). Compare different level of cutting height showed that the maximum and the minimum number of seed per panicle belonged to 7cm (429) and 17cm (347) treatments (Table 4).

Table 4. Mean comparison effect of different level of cutting height on measured traits

Cutting height (cm)	Seed yield ($gr.m^{-2}$)	1000-Seed weight (gr)	Fresh forage yield ($gr.m^{-2}$)	Dry matter yield ($gr.m^{-2}$)
17	495^{b}	24.53^{b}	9607^{b}	2193^{b}
12	516^{ab}	24.71^{b}	9719^{b}	2209^{b}
7	641^{a}	28.89^{a}	10372^{a}	2575^{a}

*Means with similar letters in each column are not significantly differentt by Duncan's test at 5% probability level.

Continue Table 4.

Cutting height (cm)	Number of seed per panicle	Number of panicle shoots	Number of fertile tiller	Number of plant per m^{-2}
17	347^{b}	13.02^{b}	1.75^{b}	17.33^{b}
12	386^{b}	14.87^{a}	2.47^{a}	18.55^{b}
7	429^{a}	15.25^{a}	2.50^{a}	22.01^{a}

*Means with similar letters in each column are not significantly differentt by Duncan's test at 5% probability level.

Evaluation mean comparison result of interaction effect of treatments indicated maximum number of seed per panicle (470) was noted for 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height and lowest one (274) belonged to 200 $kg.ha^{-1}$ urea and 17cm treatment (Table 5). Hamidi and Dabbagh Mohammadi Nasab (2000) reported that nutrients availability particularly nitrogen at critical stage of seed formation affects the number of seeds through the increase of plant growth rate. Application of biological fertilizers significantly increased the number of seeds per spikelet and these results were already reported by (Kumar *et al.,* 2009). Results of Hammad *et al.* (2011) revealed that maximum plant growth, number of kernels per ear and grain yield of maize was found in 250 kg N ha^{-1} treatment and the highest days to maturity and biological yield were recorded from 300 kg N ha^{-1} application. It has been clearly shown in the literature that applying optimum rate of N at proper time is crucial in improving crop productivity. Farmers usually apply high rates of nitrogen fertilizer to ensure the fulfillment of the crop needs, while they are using both water and nitrogen in an inefficient way by increasing leaching potential of nutrients into the ground water (Ramos *et al.*, 2012).

4.7. Number of panicle shoots

Result of analysis of variance showed effect of urea fertilizer, cutting height and interaction effect of treatments on number of panicle shoots was significant at 1% probability level (Table 2). Evaluation mean comparison result revealed in different level of urea fertilizer the maximum number of panicle shoots (15.34) was noted for 400 $kg.ha^{-1}$ and minimum of that (12.50) belonged to 200 $kg.ha^{-1}$ treatment (Table 3). Between different levels of cutting height the maximum number of panicle shoots (15.25) was observed in 7cm and the lowest one (13.02) was found in 17cm treatment (Table 4). Assessment mean comparison result of interaction effect of treatments indicated maximum number of panicle shoots (16.27) was noted for 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height and lowest one (11.18) belonged to 200 $kg.ha^{-1}$ urea and 17cm (Table 5).

4.8. Number of fertile tiller

According result of analysis of variance effect of urea fertilizer and cutting height on number of fertile tiller was significant at 5% probability level but interaction effect of treatments was not significant (Table 2). Mean comparison result of different level of urea fertilizer indicated that maximum number of fertile tiller (2.62) was noted for 400 kg.ha^{-1} urea and minimum of that (2.01) belonged to 200 kg.ha^{-1} treatment (Table 3). As for Duncan classification made with respect to different level of cutting height maximum and minimum amount of number of fertile tiller belonged to 7cm (2.5) and 17cm (1.75) (Table 4).

Table 5. Mean comparison interaction effect of treatments on measured traits

Urea (kg.ha^{-1})	Cutting height (cm)	Seed yield (gr.m^{-2})	1000-Seed weight (gr)	Fresh forage yield (gr.m^{-2})	Dry matter yield (gr.m^{-2})
200	17	480^{cd}	21.94^{c}	9320^{b}	1949^{c}
	12	486^{cd}	23.07^{bc}	9480^{a}	1990^{c}
	7	564^{b}	25.77^{b}	10253^{a}	2362^{b}
300	17	443^{d}	25.99^{b}	9600^{a}	2140^{bc}
	12	527^{bc}	25.54^{b}	9577^{a}	2327^{b}
	7	677^{a}	30.27^{a}	10390^{a}	2676^{a}
400	17	562^{b}	24.51^{bc}	10077^{a}	2451^{ab}
	12	536^{bc}	26.66^{b}	9923^{a}	2352^{b}
	7	693^{a}	30.65^{a}	10473^{a}	2686^{a}

*Means with similar letters in each column are not significantly differentt by Duncan's test at 5% probability level.

Continue Table 5.

Urea (kg.ha^{-1})	Cutting height (cm)	Number of seed per panicle	Number of panicle shoots	Number of fertile tiller	Number of plant per m^{-2}
200	17	274^{d}	11.18^{c}	1.54^{b}	15.67^{e}
	12	308^{c}	12.91^{b}	2.26^{a}	16.00^{de}
	7	397^{b}	13.38^{b}	2.24^{a}	19.00^{cd}
300	17	367^{b}	14.07^{ab}	1.60^{b}	16.00^{de}
	12	379^{b}	15.73^{ab}	2.26^{a}	19.33^{cd}
	7	467^{ab}	16.10^{a}	2.41^{a}	22.67^{a}
400	17	404^{ab}	13.80^{ab}	2.10^{ab}	20.00^{bc}
	12	424^{ab}	15.97^{ab}	2.86^{a}	20.67^{abc}
	7	470^{a}	16.27^{a}	2.91^{a}	23.33^{a}

*Means with similar letters in each column are not significantly differentt by Duncan's test at 5% probability level.

Evaluation mean comparison result of interaction effect of treatments indicated maximum number of fertile tiller (2.91) was noted for 400 kg.ha^{-1} urea fertilizer and 7cm cutting height and lowest one (1.54) belonged to 200 kg.ha^{-1} urea and 17cm (Table 5).

4.9. Number of plant per m^{-2}

Result of analysis of variance revealed effect of urea fertilizer, cutting height and interaction effect on number of plant per m^{-2} was significant at 5% probability level (Table 2). According result of mean comparison maximum of number of plant per m^{-2} (21.33) was obtained for 400 kg.ha^{-1} urea fertilizer and minimum of that (16.89) was for 200 kg.ha^{-1} treatment (Table 3). Evaluation mean comparison result indicated in different level of cutting height the maximum number of plant per m^{-2}

(22.01) was noted for 7cm and minimum of that (17.33) belonged to 17cm treatment (Table 4). Assessment mean comparison result of interaction effect of treatments indicated maximum number of plant per m^{-2} (23.33) was noted for 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height and lowest one (15.67) belonged to 200 $kg.ha^{-1}$ urea and 17cm treatment (Table 5).

5. CONCLUSION

Generally result of this research revealed 400 $kg.ha^{-1}$ urea fertilizer and 7cm cutting height had the highest amount of studied traits, so it can be advice to producers.

ACKNOWLEDGMENT

The authors thank all colleagues and other participants, who took part in the study.

FOOTNOTES

AUTHORS' CONTRIBUTION: All authors are equally involved.

CONFLICT OF INTEREST: Authors declared no conflict of interest.

FUNDING/SUPPORT: This study was done by scientific support of Department of Agronomy, Islamic Azad University, Khuzestan Science and Research Branch.

REFRENCES

Aishah, S., H. A. R. Saberi, R. A. Halim. and A. R. Zaharah. 2011. Yield responses of forage sorghums to salinity and irrigation frequency. Afr. J. Biotech. 10(20): 4114-4120.

Agriculture Online. 1999. Cut it close for best performance in alfalfa. http: //www.agriculture.com, April 9, 1999.

Almodares, A., M. Jafarinia. and M. R. Hadi. 2009. The effects of nitrogen fertilizer on chemical compositions in corn and sweet Sorghum. American-Eurasian J. Agric. Environ. Sci. 6(4): 441-446.

Beyart, R. P. and R. C. Roy. 2005. Influence of nitrogen fertilization on multi-cut forage sorghum, Sudan grass yield and nitrogen use. Agron. J. 97: 1493-1501.

Biari, A., A. Gholami. and H. A. Rahmani. 2008. Growth promotion and enhanced nutrient uptake of maize by application of plant growth promoting rhizobacteria in arid region of Iran. J. Biol. Sci. Biotech. Adv. 19: 135-138.

Chuck, C. J. and J. Donnelly. 2014. The compatibility of copper potential with saline water in sorghum cultivars. Apply of Energy. 120: 245–252.

Eskandari, H., A. Ghanbari. and A. Javanmard. 2009. Intercropping of cereals and legumes for forage production. Notulae Sci. Biol. 1: 7-13.

FAOSTAT. 2013. FAO statistical year book of 2013. Word food and Agriculture. Statistical Division of Food and Agriculture Organization of UN.

Gardner, F., R. Pearce. and R. L. Mitchell. 1985. Physiology of crop plants. Iowa State Univ. Press. Ames.

Garg, B. K., S. Kathju. and S. P. Vyas. 2005. Salinity-fertility interaction on growth. Photosynthesis and nitrate reductase activity in sesame. Indian J. Plant Physiol. 10: 162-167.

Gul, I., V. Saruhan. and M. Basbag. 2005. Determination of yield and yield components and relationship among the components of grain sorghum cultivars grown as main crop. Asian J. Plant Sci. 4: 613-618.

Guo, J. H., X. J. Liu, Y. Zhang, J. L. Shen, W. X. Han, W. F. Zhang, P. Christie, K. W. T. Goulding, P. M. Vitousek. and F. S. Zhang. 2010. Significant acidification in major Chinese croplands. Sci. J. 327: 1008-1010.

Hamidi, A. and A. Dabbagh-Mohammadi-Nasab. 2000. Effects of plant density on crop nitrogen use efficiency in corn hybrid. J. Agri. Sci. 10: 57-43.

Hammad, H. M., A. Ahmad, A. Wajid. and J. Akhter. 2011. Maize response to time and rate of nitrogen application. Pakistan J. Bot. 43: 1935-1942.

Karimi, A. and M. Naderi. 2007. Yield and water use efficiency of forage corn as influenced by superabsorbent polymer application in soils with different texture. J. Agri. Res. 3: 187-198.

Kumar, B., P. Pandey. and D. K. Maheshwari. 2009. Reduction in dose of chemical fertilizers and growth enhancement of sesame with application of rhizospheric competent *P. aeruginosa* LES4. Europe. J. Soil Biol. 45: 334–340.

Moghimi, N. and Y. Emam. 2015. Growth and yield responses of two forage sorghum cultivars to different nitrogen fertilizer rates. J. Iran Agri. Res. 34(1) 39-45.

Olugbemi, O. 2017. Sweet sorghum and nitrogen fertilizer application: A review. J. Agri. Sci. 2: 28-35.

Ramos, T. B., J. Simunek, M. C. Goncalves, J. C. Martins, A. Prazeres. and L. S. Pereira. 2012. Two-dimensional modeling of water and nitrogen fate from sorghum irrigated with fresh and blended saline waters. J. Agri. Water Manage. 111: 87-104.

Roy, R. C., A. Sagar, J. E. Tajkia, Md. A. Razzak. and A. K. M. Zakir Hossain. 2018. Effect of salt stress on growth of sorghum germ plasms at vegetative stage. J. Bangladesh Agri. Univ. 16(1): 67-72.

Sadeghzade, A., M. Tajbakhsh. and A. Jalili A. 2012. Effects of foliar application of stimurel, Force 4-L and Dulzee on yield of sorghum speedfeed. Int. Res. J. Biotech. 3(1): 018-021.

Singh, M., B. A. Krantz. and G. B. Baird. 1972. Agronomic production techniques in sorghum. *In*: G. P. N. Rao. and L. R. House. (Eds.). Sorghum in seventies. Oxford and IBH Publ. Co. New Delhi. India. pp: 302-333.

Singh, D. K., A. K. Pandey, U. B. Pandey. and S. R. Bhonde. 2002. Effect of farmyard manure combined with foliar application of NPK mixture and micronutrients on growth, yield and quality of Onion. Newsletter-Natl. Horti. Res. Develop. Found. 21-22: 1-7.

Shamme, S. K, C. V. Raghavaiah, T. Balemi. and I. Hamza. 2016. Sorghum growth, productivity, nitrogen removal, N-use efficiencies and economics in relation to genotypes and nitrogen nutrition in Kellem-Wollega zone of Ethiopia. Adv. Crop Sci. Tech 4: 218-226.

Smith, D. and C. J. Nelson. 1967. Growth of birds foot trefoil and alfalfa. I. Responses to height and frequency of cutting. Crop Sci. 7: 130-133.