Effect of NPK Fertilization Rates and Splitting on the Grain Yield and its Components of Two Sorghum Cultivars

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Abstract:

A field experiment was conducted at the Agronomy Department Farm, Faculty of Agriculture, Assiut University during the 2012 and 2013 summer growing seasons to study the effect of NPK fertilization rates and splitting on the grain yield and its components of two sorghum cultivars. The experiment was carried out in a randomized complete block design (RCBD) using split-split plot arrangement with three replicates. Cultivars were occupied at main plot while NPK rates were allotted on sub plot and splitting doses of NPK were allocated on sub sub plot. The obtained results showed that:

Plant height, Panicle weight, Seed index and Grain yield /fed were affected significantly by studied cultivars in both seasons. Giza 15 cultivar surpassed the Dorado one and gained the highest mean values of mentioned traits in both seasons. The application of NPK fertilizers exerted a significant influence on plant height, panicle weight, seed index and grain yield /fed in the two growing seasons. The highest mean values of panicle weight, seed index and grain yield fed^{-1} were obtained when sorghum plants fertilized by 125% NPK/fed of the recommended fertilizers in both seasons. Splitting NPK into four equal doses resulted in the highest mean value of plant height in both seasons while, panicle weight, seed index and grain yield /fed traits were responded to three equal doses in the two growing seasons. Also, the all first order interactions (varieties × NPK rates, varieties × splitting number and NPK rates × splitting) exerted a significant influence on plant height, panicle weight, seed index and Grain yield /fed in both seasons. The second order interaction (varieties × NPK rates × splitting) exerted a significant influence on plant height; panicle weight, seed index and grain yield /fed in the two growing seasons. The highest value of grain yield/ fed was obtained from Giza 15 cultivar when received the highest NPK rate (125% NPK/fed of the recommended fertilizers) applied at three equal doses in both seasons.

Key words: Sorghum, NPK. Fertilization rates and splitting.

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Introduction:

Sorghum [*Sorghum bicolor* (L) Moench] is the fifth most important cereal crop in the world (Kole, 2011; Agrama and Tunstra, 2003) and considered one of the most important grain crops for vast number of people in Upper Egypt especially in Assiut and Sohag Governorates. NPK fertilization rates and splitting are very important agricultural practices for sorghum, which greatly affect yield and its components. Different new cultivars were released. There cultivars need some information about agricultural practices to reach the potentiality of such cultivars. Allam *et al.* (2002) reported that the highest grain yield / fed was obtained from Mina cultivar (24.27 ardab/fed) followed by shandaweel (22.83 ardeb/fed) and the lowest yield was recorded from Dorado cultivar (19.08 ardab/fed). El–Aref *et al.* (2005) reported that cultivars exerted a significant influence on panicle weight, 1000 – grain weight and grain yield. Shandaweel- 2 hybrid were superior for all characters understudy, compared to Dorado variety. Alsadoon and Addaheri (2011) reported that, Cultivars exerted a significant influence on 1000-grain weight and grain yield in both season. Inkath cultivar produced the highest grain yield 6.17 and 6.47 t/ha in spring and fall seasons, respectively. Singh and Sumeriya (2012) showed that plant height was significantly improved by different elite fodder sorghum genotypes. Ochieng *et al.* (2013) found that, variety E1291 showed better yield as compared to Ochuti. Fertilizers play a key role in achieving the potential of different crops. High yielding varieties of crops, especially sorghum need high nutritional requirements generally give marked response to N, P and K fertilizer (Sharma and Das, 1982). It is essential to know the best level of fertilizers application for getting a higher crop yield so that maximum benefits could be achieved. Here too Nutrient inputs from chemical fertilizers are needed to replace nutrients which are exported and lost during cropping, to maintain positive nutrient balances (Buah and Mwinkaara, 2009). Nitrogen, phosphorus and potassium are the major macronutrients that are most limiting in grain sorghum production worldwide. Allam *et al.* (2002) reported that the application of nitrogen fertilizer exerted a significant influence on panicle weight, seed index and grain yield /fed where, the maximum values were obtained when the highest rate was applied (120 kg N/fed.). El–Aref *et al.* (2005) reported that Nitrogen fertilization to grain sorghum cultivars exerted a significant influence on panicle weight, 1000 – grain weight and grain yield. The maximum values of these characters were obtained when the highest level of N was applied (125 kg N/fed). Khalili *et al.* (2008) found that there was a significant difference among fertilizing treatments on grain yield. Miko and Manga (2008) found that nitrogen significantly influenced on plant height and grain yield. The response of sorghum yield to nitrogen was up to 60 and 90kg N/ha in 1999 and 2001 respectively. The increase in yield when these responses were compared to plots that did not receive nitrogen was 32.44 and 27.0% for 1999 and 2001, respectively. Rashid *et al.* (2008) reported that the grain yield increased from 2.92 to 5.61 t/ha in the plots that were treated with 90 kg N/ ha compared with the control plots. Afzal *et al.* (2012) found that the plant height increased by increasing nitrogen levels. Zand *et al.* (2014) found that the effect of Nitrogen application rate was significant for grain yield per unit area whereas, the effect of Nitrogen application rate was not significant for 1000 grains weight per unit area. The proposed studies in this respect are to split the fertilizers into different doses to maximize the profits of such fertilizers. The importance of splitting could be ascribed to one or more of the following. Splitting the fertilizers may decrease the rate of leaching. Splitting the fertilizers at different stages of growth is very important to face the different requirements of NPK. This could maximize the benefit of NPK. Tolessa *et al.* (1994) reported that Split application of nitrogen is one of the methods to improve nitrogen use by the crop while reducing the nutrient loss through leaching and volatilization. Osman (2006) stated that the applications of N fertilizer in three equal doses significantly increased maize grain yield/fed. Ali (2010) indicated that increasing nitrogen splitting numbers significantly increased plant height, 1000-grain weight, grain weight / panicle and grain yield in the two growing seasons. Moreover, splitting nitrogen rates to nine equal doses significantly increased pearl millet grain yield /ha as compared to six or three splits. Tadesse *et al.* (2013) found that, differences among N application times were significant for maize grain yield. The highest grain yield (7908 kg/ha) was observed when nitrogen was applied $^1/_3$ at planting and $^2/_3$ at knee height.

The aim of this study is investigate the effect of NPK fertilization rates and splitting on the grain yield and its components of two sorghum cultivars.

Materials and methods:

This investigation was carried out at Agronomy Department Farm, Faculty of Agriculture, Assiut University, during 2012 and 2013 seasons to study the effect of NPK fertilization rates and splitting on the grain yield and its components of two sorghum cultivars ie; Dorado (C_1) & Giza 15 (C_2).

The experiment was carried out in a randomized complete block design (RCBD) using split-split plot arrangement with three replicates. The first variable was cultivars which occupied the main-plots. Sorghum cultivars were planted on July 2nd and 1st in the two growing seasons of 2012 and 2013, respectively. After three weeks from planting, plants were thinned into two plants per hill. All other agricultural practices were carried out as recommended for grain sorghum in both seasons. The preceding crop was wheat (Triticum aestivum L.) in both seasons.

The second variable was the NPK rates. This variable allotted in the sub-plots. Three rates of NPK were studied as follows:

1- Low rates 75%, of the recommended NPK fertilizers (Q_1), (75, 23.25 and 18) unit /fed for N. P and K, respectively.

2- Recommended rates 100 % (Q_2), (100, 31 and 24) unit /fed for N. P and K, respectively.

3- High rates, 125 % of the recommended NPK fertilizers (Q_3), (125, 38.75 and 30) unit /fed for N. P and K, respectively.

The NPK fertilization rates were applied in the form of Urea (46.5% N), Calcium super phosphate (15.5% P_2O_5) and potassium sulfate (48% K_2O), were used as a source of nitrogen, phosphorus and potassium, respectively.

The third variable was the splitting of NPK. This variable occupied in the sub-sub plots. The treatments in this respect were as follows:

1. The fertilization of NPK i.e. 75: 23.25:18, 100:31:24, 125:38.75:30 unit/fed for $N:P_2O_5:K_2O$, respectively. These doses were applied before the second irrigation (Sp_1).
2. Splitting the fertilizers doses into two equal parts before the second and third irrigations (Sp_2).
3. Splitting the fertilizers doses into three equal parts before the second, the third and the fourth irrigation (Sp_3).
4. Splitting the fertilizers doses in to four equal parts before the second, third, fourth and fifth irrigations (Sp_4).

The soil used for these experiments was clay and its structure as presented in Table 1.

PROPERTIES	2012	2013
Mechanical analysis		
Sand	27.00	26.46
Slit	30.40	33.29
Clay	42.60	40.25
Soil texture	Clay	Clay
Chemical analysis		
Total $CaCO_3$%	0.88	1.20
Total N%	0.30	0.18
K	296.40	273.00
P	12.00	14.00
Cu	3.070	3.230
Fe	14.50	15.46
Mn	3.51	3.85
Zn	0.55	0.78

The above analysis was carried out in the Agricultural Research Center Soil, Water & Environment Res. Institute Unit of Analysis & Studies. The experimental unit area was 12 m^2 (3×4) including 6 ridge of 60 cm apart at spacing 20 cm between hills.

Data were recorded by using competitive plants from each sub-sub plot (12 m^2). A plant was considered competitive when it was guarded from four sides, i.e. two sides on the same ridge and the other two sides on the adjacent ridges. Random samples of five plants were chosen from the six inner rows of every sub-sub plot. This sampling was done in three replications of each experiment at the harvest time; these characters were recorded on October 22 and 25 in 2012 and 2013 seasons, respectively. The following characters were recorded. Plant height (cm), Panicle weight (g), Seed index (g) and Grain yield /fed. (ardab =140 kg ,fed = 4200 m^2): this was calculated using the grain yield/plot.

All collected data were analyzed with analysis of variance (ANOVA) procedures using the MSTAT_C Statistical Software Package (Michigan State university, 1983). The significant means of any trait studied were compared using LSR at 5% probability rate according to Fisher (1964).

Results and Discussion:

Yield attributes:-

Data presented in Tables 2-4 reveal that plant height, panicle weight and seed index were affected significantly by studied cultivars in both seasons. Giza 15 cultivar surpassed Dorado one in this respect and produce the highest mean values of mentioned traits (318.1 cm, 123.5 g and 55.9 g of plant height, panicle weight and 1000 grain weight in first season, respectively being 296.2 cm, 136.4g and 58.6g in the second season in the same order). The differences between cultivars are mainly due to the interaction between their genetic make up during growth periods and to the environmental factors prevailing during their development. These results are in general harmony with those obtained by Mohamed (2002), El-Aref and Ibrahim (2004), El–Aref *et al.* (2005), Al-sadoon and Addaheri (2011) and Singh and Sumeriya (2012).

NPK fertilizers for grain sorghum cultivars exerted a significant influence on plant height, panicle weight and seed index. Data reveal that increasing NPK rate increased plant height, panicle weight and seed index. The maximum values of these characters were obtained when the highest rate of NPK was applied (125 % NPK/fed of the recommended fertilizers) except plant height in first season which reacted to 100 % NPK of recommended. It is clear from these data that NPK fertilizers to grain sorghum enhanced the vegetative growth of the plants, increased photosynthetic activity and the metabolites required to produce vigorous growth. The increase of plant height due to NPK fertilizers could be ascribed to the role of NPK in stimulating cell division and elongation. It is clear from these data that NPK fertilizers enhanced the vegetative growth of the plants, increased photosynthetic activity and the metabolites required to produce vigorous growth and consequently produced wide and heavy panicles. This means that NPK increased seed weight by increasing the amount of metabolite directed to the grains during filling period These results are in accordance with those obtained by Allam *et al.* (2002), Mohamed (2002), El-Aref and Ibrahim (2004) and El–Aref *et al.* (2005), Buah and Mwinkaara (2009), Roy and Khandaker (2010), Yagoub and Abdelsalam (2010), Al-sadoon and Addaheri (2011), Afzal *et al.* (2012), Buah *et al.* (2012) and Singh and Sumeriya (2012).

Here too, the illustrated data focus that the above mentioned traits reacted significantly to NPK fertilizer splitting in the two growing seasons. The tallest plants (218.1 and 202.0 cm in the first and second seasons, respectively) were obtained from the high number of splitting (four times) while the highest mean values of panicle weight and 1000-grain weight (122.1 and 44.4g for panicle weight and 1000-grain weight in the first season, respectively being 135.3 and 46.1g in second season) were obtained when NPK fertilizers split to three equal doses. The lowest values of these characters were observed when application the fertilizers in one full dose after thinning. The increase here by increasing NPK application number might be attributed to saving NPK in proper time and maximizing the NPK utilization through minimizing losses of the applied NPK. These results are in line with those obtained by Mengel and Kirkby (2001), Ata Allah *et al.* (2002), Rizwan *et al.* (2003), Dixit *et al.* (2004), Ali (2010) and Arefaine (2013).

The interaction of cultivars × NPK rates exerted a significant influence on plant height, panicle weight and seed index in both seasons. The maximum mean values of these traits were obtained from Giza 15 cultivar when received the highest NPK rate (125% NPK/fed of the recommended fertilizers) in both seasons except plant height in first season which reacted to 100 % NPK of recommended. The interaction of cultivars × splitting number exerted a significant influence on plant height, panicle weight and seed index in both seasons. The maximum mean values of panicle weight and 1000-grain weight were obtained from Giza 15 cultivar with three equal doses application in both seasons, where the highest value of plant height was obtained from Giza 15 cultivar with two equal doses of application in 2012 season. While in 2013 season the highest mean value of plant height was obtained from Giza 15 cultivar with four equal doses of application. Also the interaction of NPK rates × splitting number exerted a significant influence on plant height, panicle weight and seed index in both seasons Moreover, the second order interaction (cultivars × NPK rates × splitting number) had significant effect on all studied traits.

Grain yield/fed. (ardab):

The data presented in Table 5 reveal that the effect of cultivars on grain yield / fed. (ardab) was significant in both seasons. It is noteworthy to mention that Giza 15 cultivar was significantly superior in grain yield as compared with Dorado one. Giza 15 cultivar produced the highest mean values of grain yield (18.5 and 18.3 ardab/fed in the first and second seasons, respectively). This is to be expected since the same cultivar produced the highest mean values of panicle weight and seed index in the two growing seasons. These results are in general harmony with those obtained by Al-sadoon and Addaheri (2011) and Ochieng *et al.* (2013).

Regarding NPK fertilization the results in the same table show that the grain yield /fed increased significantly by increasing rates of NPK rates in both seasons. Applying 125% NPK/fed of the recommended fertilizers was more effective compared with other NPK rates. The grain yield increase per feddan in this study could be due to the increases in the metabolites synthesized by plants, that may depend to a large extent upon the favorable effect of nitrogen rate in the metabolic processes and physiological formation of plant organs. Moreover, the present results might be attributed to the effect of nitrogen fertilization on the vigorous vegetative growth and accumulation of photosynthesis assimilates. These results are in accordance with those obtained by Khalili *et al.* (2008), Miko and Manga (2008), Rashid *et al.* (2008), Singh and Sumeriya (2012), Ochieng *et al.* (2013) and Zand *et al.* (2014). However, Barbanti *et al.* (2006) found that, in northern Italy there was no yield response to nitrogen fertilization on a soil that already had a high amount of nitrates. Also Marsalis *et al.* (2009), in New Mexico, found no nitrogen response at nitrogen rates under the study. One reason may have been that these rates were at or above that required for achieving maximum yield in that area.

From the same table indicate that Splitting NPK into three equal doses resulted to produce highest value of grain yield /fed in both seasons. It was observed that when NPK is applied in splits, crop do not suffer at any stage of development and this may be due to saving the required supply at the time of peak demand, therefore better yield components were recorded. The lowest grain yield was observed when application the fertilizers in one full dose after thinning. This may be attributed to the asynchrony in the time of availability of sufficient amounts of the nutrient in the soil proportionate with the demand of the plant for uptake. The present trend could be ascribed to one or more of the following:

a- Splitting the fertilizers may decrease the rate of leaching.

b- Splitting the fertilizers at different stages of growth is very important to face the different requirements of NPK. This could maximize the benefit of NPK.

c- The Egyptian soil is tended to be alkali in the presence of calcium carbonate. This salt may change the majority of added nitrogen into ammonia which easily lost. Then splitting the fertilizers may avoid this loss.

It is clear that the above factors revealed the importance of splitting the fertilizers and need further investigation in this respect. These results are in line with those obtained by Osman (2006), Walsh (2006), Ali (2010), Saleem *et al.* (2011) and Arefaine (2013).

The first order interaction of cultivars × NPK rates exerted a significant influence on grain yield /fed. in both seasons. The maximum value of grain yield was obtained from Giza 15 cultivar when received the highest NPK rate (125% NPK/fed of the recommended fertilizers) in both seasons. The interaction of cultivars × splitting number exerted a significant influence on grain yield /fed. in both seasons. The maximum value of grain yield was obtained from Giza 15 cultivar with three equal doses application in both seasons. Also, the interaction of NPK rates × splitting number exerted a significant influence on grain yield /fed. in both seasons. The maximum value of grain yield was obtained from grain sorghum plants fertilized by 125% NPK/fed of the recommended fertilizers applied at three equal doses in both seasons. Moreover, all interactions (cultivars × NPK rates × splitting number) under study had significant effect on grain yield /fed in both seasons. The maximum value of grain yield was obtained from Giza 15 cultivar when received the highest NPK rate (125% NPK/fed of the recommended fertilizers) applied at three equal doses in both seasons.

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Table 2. Effect of sorghum cultivars, NPK rates, splitting and their interactions involved on plant height (cm).

Seasons	Cultivars / Splitting	C1 Q1	C1 Q2	C1 Q3	Mean	C2 Q1	C2 Q2	C2 Q3	Mean	Q1	Q2	Q3	Mean
2012	Sp1	111.3 E	108.7 E	118.7 E	**112.9 c**	296.7 D	323.3 AB	315.3 BC	**311.8 b**	204.0 b	216.0 a	217.0 a	**212.3 B**
	Sp2	112.3 E	112.3 E	114.3 E	**113.0 c**	313.7 BC	323.0 AB	329.7 A	**322.1 a**	213.0 a	217.7 a	222.0 a	**217.6 A**
	Sp3	116.0 E	120.3 E	108.3 E	**114.9 c**	309.3 C	321.0 A-C	321.7 A-C	**317.3 ab**	212.7 a	220.7 a	215.0 a	**216.1 AB**
	Sp4	113.1 E	115.0 E	117.3 E	**115.2 c**	316.0 BC	325.5 AB	321.5 A-C	**321.0 a**	214.6 a	220.3 a	219.4 a	**218.1 A**
Mean		**113.2 C**	**114.1 C**	**114.7 C**	**114.0**	**308.9 B**	**323.2 A**	**322.0 A**	**318.1**	**211.1 B**	**218.6 A**	**218.4 A**	**216.0**
2013	Sp1	102.9 G	101.6 G	102.8 G	**102.4 c**	295.3 CD	289.7 D-F	286.3 F	**290.4 b**	199.1 cd	195.6 d	194.6 d	**196.4 B**
	Sp2	102.0 G	102.2 G	106.0 G	**103.4 c**	288.0 EF	293.4 DE	295.3 CD	**292.2 b**	195.0 d	197.8 cd	200.7 bc	**197.8 B**
	Sp3	102.3 G	103.6 G	103.0 G	**103.0 c**	300.7 BC	294.7 CD	306.3 AB	**300.6 a**	201.5 a-c	199.1 cd	204.7 ab	**201.8 A**
	Sp4	102.3 G	101.1 G	103.7 G	**102.4 c**	296.0 CD	301.0 BC	307.7 A	**301.6 a**	199.1 cd	201.1 a-c	205.7 a	**202.0 A**
Mean		102.4 C	102.1 C	103.9 C	**102.8**	295.0 B	294.7 B	298.9 A	**296.2**	198.7 B	198.4 B	201.4 A	**199.5**

C: cultivars (C_1: Dorado & C_2: Giza 15), Q: NPK rates, Sp: Splitting number

Q ABC
SP ABC
C×Q ABC
C×SP abc
Q×SP abc
C×Q×SP ABC

Table 3. Effect of sorghum cultivars, NPK rates, splitting and their interactions involved on panicle weight (gm).

Seasons	Cultivars		C1			Mean	C2			Mean	Q1	Q2	Q3	Mean
	Splitting	NPK	Q1	Q2	Q3		Q1	Q2	Q3					
2012	Sp1		89.7 G	91.7 FG	108.0 B-G	**96.6** e	115.3 A-G	115.0 A-G	122.7 A-D	**117.7** bc	102.5 b	103.3 b	115.5 ab	**107.1** B
	Sp2		101.O D-G	103.0 B-G	95.3 E-G	**99.9** de	118.7 A-E	120.3 A-E	128.0 A-D	**122.3** ab	109.8 b	111.8 b	111.7 b	**111.1** B
	Sp3		104.0 B-G	113.0 B-G	120.0 A-E	**112.0** b-d	124.3 A-D	129.3 A-C	141.7 A	**131.8** a	114.3 ab	121.0 ab	131.0 a	**122.1** A
	Sp4		102.0 C-G	102.0 D-G	109.0 B-G	**104.0** c-e	119.7 A-E	116.7 A-F	130.0 AB	**122.1** ab	111.0 b	109.2 b	119.7 ab	**113.3** AB
Mean			**99.3** C	**102.0** C	**108.0** BC	**103.0**	**119.5** AB	**120.0** AB	**130.6** A	**123.5**	**109.4** B	**111.3** AB	**119.5** A	**113.4**
2013	Sp1		98.3 H	98.3 H	110.7 GH	**102.4** e	122.7 C-G	120.3 D-G	134.3 A-F	**125.8** cd	110.5 d	109.3 d	122.5 b-d	**114.1** C
	Sp2		115.0 F-H	122.0 D-G	121.7 D-G	**119.4** d	127.7 B-G	132.7 A-F	141.7 A-D	**134.0** bc	121.2 cd	127.3 a-c	131.7 a-c	**126.B** B
	Sp3		118.0 E-G	129.0 B-G	127.3 B-G	**124.8** cd	138.7 A-E	145.3 AB	153.7 A	**145.9** a	128.5 a-c	137.0 ab	140.5 a	**135.3** A
	Sp4		119.0 E-G	121.0 D-G	119.7 E-G	**119.8** d	136.0 A-F	139.7 A-E	143.7 A-C	**139.8** ab	127.5 a-c	130.2 a-c	131.7 a-c	**129.8** AB
Mean			113.0 C	117.0 C	119.8 C	**116.6**	131.3 B	135 AB	143.3 A	**136.4**	121.9 B	126.0 AB	131.6 A	**126.5**

Table 4. Effect of sorghum cultivars, NPK rates, splitting and their interactions involved on seed index (gm).

Seasons	Cultivars: Splitting / NPK	C1 Q1	C1 Q2	C1 Q3	Mean	C2 Q1	C2 Q2	C2 Q3	Mean	Q1	Q2	Q3	Mean
2012	Sp1	25.1 D	26.5 D	25.3 D	**25.6 d**	50.8 C	53.O BC	56.4 A-C	53.4 b	37.9 c	39.7 bc	40.9 bc	**39.5 *C***
	Sp2	27.3 D	27.5 D	29.7 D	**28.1 cd**	53.O BC	54.9 A-C	56.5 A-C	54.8 b	40.1 bc	41.2 bc	43.1 a-c	**41.5 *BC***
	Sp3	28.1 D	29.6 D	32.3 D	**30.O c**	58.2 A-C	57.5 A-C	60.9 A	58.9 a	43.2 a-c	43.5 ab	46.6 a	**44.4 *A***
	Sp4	27.7 D	29.2 D	28.2 D	**28.4 cd**	54.6 A-C	55.2 A-C	59.6 AB	56.4 ab	41.1 bc	42.2 a-c	43.9 ab	**42.4 *AB***
Mean		**27.O B**	**28.2 B**	**28.9 B**	**28**	**54.1 A**	**55.1 A**	**58.3 A**	**55.9**	**40.6 *A***	**41.6 *A***	**43.6 *A***	**42.O**
2013	Sp1	27.9 F	28.0 F	28.5 EF	**28.1 e**	55.0 CD	56.9 BD	57.1 B-D	56.3 c	41.4 ef	42.4 d-f	42.8 d-f	**42.2 *B***
	Sp2	30.5 EF	31.5 EF	34.8 E	**32.3 d**	51.0 D	60.1 A-C	60.2 A-C	57.1 bc	40.8 f	45.8 a-e	47.5 a-c	**44.7 *A***
	Sp3	32.1 EF	31.8 EF	30.7 EF	**31.5 de**	55.4 CD	63.8 A	62.6 AB	60.6 a	43.8 b-f	47.8 ab	46.6 a-d	**46.1 *A***
	Sp4	27.8 F	30.5 EF	33.8 EF	**30.7 de**	58.3 A-C	59.4 A-C	63.4 AB	60.4 ab	43.0 c-f	45.0 a-f	48.6 a	**45.5 *A***
Mean		30.0 C	30.5 C	31.9 C	**30.7**	54.9 B	60.0 A	60.8 A	58.6	42.3 *B*	45.2 *AB*	46.4 *A*	**44.6**

Table 5. Effect of sorghum cultivars, NPK rates, splitting and their interactions involved on grain yield / fed. (ardeb) at harvest.

seasons	Cultivars	C1			Mean	C2			Mean	Q1	Q2	Q3	Mean
	Splitting | NPK	Q1	Q2	Q3		Q1	Q2	Q3					
2012	Sp1	12.2 K	14.4 H-K	14.1 I-K	**13.5 d**	14.4 H-K	15.0 G-J	17.8 B-E	15.7 bc	13.3 f	14.7 ef	15.9 de	**14.6 C**
	Sp2	13.4 JK	15.3 F-J	16.2 E-I	**15.0 bc**	16.6 E-H	19.4 A-D	20.0 AB	18.6 a	15.0 e	17.3 b-d	18.1 a-c	**16.8 B**
	Sp3	15.6 E-J	15.6 E-J	17.2 D-G	**16.1 b**	17.5 C-F	20.9 A	21.2 A	19.9 a	16.6 cd	18.3 ab	19.2 a	**18.0 A**
	Sp4	14.7 H-J	14.4 H-K	15.3 F-J	**14.8 c**	19.1 A-D	19.7 A-C	20.6 A	19.8 a	16.9 b-d	17.0 b-d	18.0 a-c	**17.3 AB**
Mean		**14.0 D**	**14.9 CD**	**15.7 BC**	14.9	**16.9 B**	**18.7 A**	**19.9 A**	18.5	**15.4 B**	**16.8 A**	**17.8 A**	16.7
2013	Sp1	12.5 KL	11.9 L	13.4 J-L	**12.6 f**	15.3 G-J	15.3 G-J	18.1 C-F	16.3 c	13.9 e	13.6 e	15.8 cd	**14.4 D**
	Sp2	13.4 J-L	14.4 I-K	14.1 I-L	**14.0 e**	15.9 F-I	17.2 E-H	19.7 B-D	17.6 b	14.7 de	15.8 cd	16.9 bc	**15.8 C**
	Sp3	15.0 H-J	15.3 G-J	17.5 D-G	**15.9 cd**	18.4 B-E	20.3 BC	23.1 A	20.6 a	16.7 bc	17.8 b	20.3 a	**18.3 A**
	Sp4	14.1 I-L	15.0 H-J	15.9 F-I	**15.0 de**	17.2 E-H	18.4 B-E	20.6 B	18.8 b	15.6 cd	16.7 bc	18.3 b	**16.9 B**
Mean		13.8 D	14.1 CD	15.0 C	**14.4**	16.7 B	18.0 B	20.4 A	18.3	15.2 B	16.0 B	17.8 A	16.3

تأثير مستويات وتقسيم الجرعات السمادية علي المحصول ومكوناته لصنفين من الذرة الرفيعة

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الملخص:

أجريت تجربة حقلية بمزرعة قسم المحاصيل، كلية الزراعة - جامعة أسيوط خلال موسمي النمو ٢٠١٢ و ٢٠١٣ وذلك لدراسة تأثير مستويات وتقسيم الجرعات السمادية علي المحصول ومكوناته لصنفين من الذرة الرفيعة. وقد استخدم تصميم القطاعات الكاملة العشوائية بترتيب القطع المنشقة مرتين واستعمل ثلاث مكررات. وقد رتبت الأصناف في القطع الرئيسية بينما معدلات التسميد من الـ NPK عينت في القطع المنشقة الاولى ، أما تقسيم الجرعات السمادية من الـ NPK وزعت في القطع المنشقة الثانية.

والنتائج المتحصل عليها يمكن تلخيصها على النحو التالي: وجد أن الصفات التي تم دراستها عند الحصاد وهي طول النبات، معامل وزن البذرة ، وزن النورة ومحصول الحبوب للفدان تأثرت معنويا بالأصناف لكلا الموسمين. الصنف جيزة ١٥ تفوق على الصنف دورادو في الصفات في كلا الموسمين. وجد أن استخدام المعدلات السمادية المختلفة من الـ NPK أثرت معنويا على الصفات التي تم دراستها وهي طول النبات، معامل وزن البذرة ، وزن النورة ومحصول الحبوب للفدان خلال موسمي النمو. وجد أن أعلى قيم لمعامل وزن البذرة ، وزن النورة ومحصول الحبوب للفدان أمكن الحصول عليها عندما تم التسميد بمعدل ١٢٥% من NPK في كلا الموسمين. تقسيم الجرعات السمادية من الـ NPK إلي أربع جرعات متساوية أعطت أعلى قيمة لطول النبات، بينما معامل وزن البذرة ومحصول الحبوب للفدان استجابت إلي التسميد بثلاث جرعات متساوية لكلا الموسمين. أيضا التفاعل من الدرجة الأولي بين العوامل المختلفة أثرت معنويا علي الصفات.

وبصفة عامة يمكن القول بان أعلى محصول من الحبوب للفدان أمكن الحصول عليه عندما تم زراعة الصنف جيزة ١٥ وتسميده بمعدل ١٢٥% من الموصي به من النيتروجين والفوسفور والبوتاسيوم يتم إضافتها على ثلاث جرعات متساوية لكلا الموسمين.