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Performance of Panicum under different sowing date and seeding rate in North Africa (case study Egypt)

Ayman. Mahmoud. Ali [1]* , Prof. Dr. Said Saad Soliman, Prof. Dr. El-Saadi Abdel-Hamid Ali Abdel-Mawla[2] and Prof. Dr. Adel Mohamed Mahmoud Ali[3]

1Natural Resources Department, in institute African Research and Studies and the Nile Basin Countries,
1Professor of Natural Resources in Institute for African Research and Studies and the Nile Basin Countries - Aswan University
2Professor of Crops, Faculty of Agriculture, Assiut University
3Professor of Crops, Dean of the Faculty of Agriculture, Assiut University
***Corresponding author:** Ayman Mahmoud Ali E-mail; ayman.aa972@aswu.edu.eg

ABESTRACT

A field experiment was conducted in 2021/2022 and 2022/2023 seasons to evaluate the effect of planting date and seeding rates for three cultivars of panicum. Planting was done on two planting date D1 (25/05) and D2 (25/06), seeding rate (kg/fad.) 2 kg/fed $^{-1}$ (S1), 4 kg/fed $^{-1}$ (S2), and 6 kg/fed $^{-1}$ (S3), for three different cultivars of fodder panicum (panicum super mombasa F1 (C1), panicum zori (C2) and panicum maximum mombasa (C3).

The results showed that the low seeding rate (S1) had an outperformed the leaf area index (LAI), and leaf stem ratio (LSR), while seeding rate (S3) outperformed tillers height (TH) and number of tillers (NT). While planting date (D1) outperformed (D2) in all studied traits except leaf area index (LAI), planting date (D2) outperformed (D1) and had a significant effect in the second season only. While cultivars had a different effect on the studied traits, as cultivars (C3) outperformed in tillers height (TH), the same cultivar (C1) also recorded the highest averages for the trait number of tillers (NT), cultivar (C2) outperformed and was significant in the second season only on leaf stem ratio (LSR), and the leaf stem ratio (LSR) trait cultivar (C1) recorded the highest averages among the rest of the cultivars. As for the interaction between planting date × seeding rate and planting date × cultivars, it did not have a significant effect on all the studied traits, while the interaction between seeding rate × cultivars had a significant effect ($p<0.05$) on all the studied traits, but cultivars and seeding rate differed from one trait to another. As for the three-way interaction between

planting date × seeding rate × cultivars, it had a significant effect (p<0.05) on all the traits studied except for the leaf area index (LAI), which had no significant effect in the two seasons.
Key words: Panicum, planting date, seeding rates, cultivars.

" أداء نبات البونيكام تحت مواعيد الزراعة ومعدلات البذار المختلفة في شمال أفريقيا (حالة الدراسة مصر)"

ملخص

أجريت تجربة حقلية في الموسمين ٢٠٢٢/٢٠٢١ و٢٠٢٣/٢٠٢٢ لتقييم تأثير موعد الزراعة ومعدلات البذار لثلاثة أصناف مختلفة من نبات البونيكام لتقييم صفات دليل مساحة الورقة، ارتفاع النباتات سم، عدد النباتات م٢، نسبة الساق الي الاوراق. نفذت التجربة بتصميم القطاعات الكاملة العشوائية بترتيب القطع العشوائية مرتين (RCBD) بأربعة مكررات، حيث تمت الزراعة في موعدين للزراعة (٢٥/٠٥) و(٢٥/٠٦) بمعدل بذر ٢ كجم/ فدان، ٤ كجم/ فدان و٦ كجم/ فدان، لثلاثة أصناف مختلفة من علف البونيكام (البونيكام سوبر مومباسا F1) بونيكام زوري، بونيكام ماكسيوم مومباسا.

أظهرت النتائج أن معدل البذر المنخفض (S1) تفوق على مؤشر مساحة الورقة (LAI) ونسبة ساق الورقة (LSR)، في حين تفوق معدل البذر (S3) على ارتفاع الحارثين (TH) وعدد الحراثات (NT). بينما تفوق موعد الزراعة (D1) على (D2). في جميع الصفات المدروسة باستثناء مؤشر المساحة الورقية (LAI)، تفوق موعد الزراعة (D2) على (D1) وكان له تأثير معنوي في الموسم الثاني فقط. بينما كان للأصناف تأثير مختلف في الصفات المدروسة، حيث تفوق الصنف (C3) في ارتفاع الحراثات (TH)، كما سجل نفس الصنف (C1) أعلى متوسطات في عدد صفات الحراثات (NT)، وتفوق الصنف (C2) في الأداء. وكانت معنوية في الموسم الثاني فقط في نسبة الساق الورقية (LSR)، وسجل الصنف C1 لنسبة الساق الورقية (LSR) أعلى المعدلات بين بقية الأصناف. أما التداخل بين موعد الزراعة × معدل البذر وموعد الزراعة × الأصناف فلم يكن له تأثير معنوي في جميع الصفات المدروسة، بينما كان للتفاعل بين معدل البذار × الأصناف تأثير معنوي (P<0.05) في جميع الصفات المدروسة. الصفات، ولكن الأصناف ومعدل البذر يختلف من صفة إلى أخرى. أما التداخل الثلاثي بين موعد الزراعة × معدل البذار × الأصناف فقد كان له تأثير معنوي (p<0.05) في جميع الصفات المدروسة باستثناء مؤشر المساحة الورقية (LAI) الذي لم يكن له تأثير معنوي في الموسمين.

الكلمات المفتاحية: البونيكام، موعد الزراعة، معدلات البذار، الأصناف

INTRODUCTION

In Egypt, the value of local production (self-sufficiency) of red meat decreased to 53.6% in 2021, compared to local production in 2009, which represented a self-sufficiency rate of 88.8%, and the number of livestock and livestock decreased from 19.9 million in 2009 to 8.1 million in 2021, **Central Agency for Public Mobilization and Statistics. (2023).**

The per capita share of animal protein in Egypt represents 29 grams/day in 2019, as it is lower than the safe limit recommended by international organizations by about 17% (which recommends a rate of 34 grams/day/capita). Hence, sustainable agricultural development aimed to reach the per capita share. of animal protein: 33 grams/day by 2030., **Mohamed Ali. (2023).**

The panicum crop is an alternative to coarse fodder in animal feed due to its water requirement being reduced by about 40% compared to alfalfa. It is one of the non-traditional perennial fodders crops whose cultivation is good because it tolerates high salinity, it tolerates heat stress and tolerates salinity. Its cultivation is good in low-exploitation lands affected by salinity, where it can reach Its productivity ranges between 20-25 tons per acre annually, in addition to its high rate of palatability to animals, which increases its ability to face rising costs. Due to the connection between the demand for fodder and the demand derived from the demand for livestock, the production of panicum becomes more profitable at production, because relying on it for feeding animals. On the farm, it contributes to reducing feeding costs when used as an alternative to high-cost roughage, it reduces the feeding costs of the head by about 33.3% when used as a substitute for rough alfalfa feed., **Gamal and Rabab (2023).**

"Panicum" is a forage plant whose scientific name is "Panicum maximum cv. Mombasa" that belongs to the Poaceae family and is considered the best type of forage., ***Fernandes et al*. *(2015)***. panicum maximum (guinea grass) is native to Africa but this grass was introduced to almost all tropical countries as a source of animal forage .It considered to be a high-quality cut-and-carry grass for dairy and beef cattle and not a grazed pasture grass, unlike in Brazil, where it is widely used for grazing. Mombasa guinea grass (P. maximum cv. Mombasa) was introduced to Thailand in 2007 from Brazil, where it produces high amounts of good quality herbage., ***Michael et al. (2014).*** Panicum is distinguished by its record length reaching 162.42 cm, leaf length 141.66 leaves, leaf ratio and width 5.50 cm, and number of leaves 5.66., **Al-Ghalib and Nader (2019).**

MATERIAL AND METHODS

This experiment was conducted in the experimental fields of the Green Fodder Farm - Aluminum Company, Naga Hammadi, Qena Governorate, Egypt. during the two agricultural seasons 2021/2022 and 2022/2023, To evaluate three Cultivars of Panicum Super Mombasa F1 (Spanish hybrid) (C1), Zuri Mg12 (Brazilian hybrid) (C2) and maximum Mombasa (American hybrid) (C3) under different amounts of seeding rates 2 kg/fed-1 (S1), 4 kg/fed-1 (S2), and 6 kg/fed-1 (S3) on two planting date 25/05 (D1) and 25/06 (D2).

Each planting date was a separate experiment, and then a combined analysis was conducted for the sowing date for each season separately. The experiment was carried out according to a randomized complete block design (RCBD) using four replication. The seeds were spread manually and mixed with a small amount of sand at a ratio of 1:1 due to the light weight of the seeds and the ease of carrying out the spreading process. The total number of experimental units per planting date in the season became (36) units. The area of the experimental unit was 4 m² (2×2 m). The studied traits were: -

I. Leaf area index (LAI)

It is the area of the leaf that the plant occupies above the ground (planting area). Random plants were selected with 5 plants per unit area. (The area occupied by one plant in the ground = number of plants per unit area / unit area (25 Cm ^{2})., ***(Marcos et al 2016).***

II. Tiller height (cm)

Mean of five tillers were randomly selected from the center of the unit area. They were measured from the surface of the ground to the end of the paper using a graduated metric tape., ***(Mohammed and Shaimaa 2020)***

III. Number of tillers m^{-2}

Each unit with an area of 50 × 50 cm was formed into a square and placed in the center of the experimental unit. The number of tillers per unit area was found and converted to square meters (number of tillers within unit area × 4) in order to calculate the number of tillers in 1 square meter., (***Mohammed and Shaimaa 2020*****).**

IV. Leaf -stem ratio

The leafy stem percentage was determined by cutting (5) randomly selected plants from a unit area and separating them into leaves and stems. Then the leaves and stems were wet weighed separately, then dried and weighed, and this was estimated by the following equation:
leaf stem ratio = leaf weight (g) / weight of the stem (g) × 100 (***Beyadglign et al. 2021*****).**

Average temperatures:

The average in every cut temperatures were obtained in the experimental area (Nag Hammadi - Qena) during the experimental seasons (2021/2022) and (2022/2023).

Table 1: Average air temperatures**.**

CUT	(D1) 2020/2021		(D2) 2020/2021		(D1) 2021/2022		(D2) 2021/2022	
	Average temperature							
	Min	Max	Min	Max	Min	Max	Min	Max
1	26.3	40.3	26.5	39.9	25.2	40.1	25.4	39.3

2	25.6	38.3	20.1	33.7	25.4	37.6	21.5	35.8
3	20.7	34.1	16.9	31.0	22.1	36.8	15.3	27.1
4	18.4	33.5	10.8	24.5	17.0	28.7	11.8	25.8
5	12.9	26.8	8.0	22.4	12.5	27.6	9.8	24.6
6	7.6	21.8	18.1	35.1	9.4	23.9	15.8	32.2
7	15.0	32.1	20.1	37.3	14.8	30.2	19.2	34.9
8	19.4	36.3	23.2	38.4	18.5	34.0	25.2	39.4
Total	18.2	32.9	17.9	32.8	18.1	32.4	18.0	32.4
	25.6		25.4		25.2		25.2	

Temperatures were monitored by the website "ACCUWEATHER".

RESULTS AND DISCUSSIONS

I. Leaf area index

The data in Table 2 indicate that sowing dates (D) was not significant at 5% probability level in both seasons.

Table 2: means of leaf area index (LAI) cm, as affected by planting dates(D), seeding rates(S), cultivars (C), and their interactions in 2020/2021 and 2021/2022 seasons.

Season		2020/2021				2021/2022			
Planting date (D)	Seeding rate (S) kg/fad	Cultivars (C)			**Mean**	Cultivars (C)			**Mean**
		C1	C2	C3		C1	C2	C3	
D1	S1	4.34	5.85	5.77	**5.32**	5.01	7.48	4.95	**5.81**
	S2	4.18	3.83	3.33	**3.78**	4.75	4.12	3.26	**4.04**
	S3	3.75	3.80	3.81	**3.79**	3.50	3.91	3.68	**3.69**
Mean		**4.09**	**4.50**	**4.30**	**4.30**	**2.75**	**5.17**	**3.97**	**4.52**
D2	S1	4.57	5.04	5.25	**4.95**	5.49	8.38	6.44	**6.77**
	S2	3.96	3.88	3.64	**3.82**	5.03	4.75	3.62	**4.47**
	S3	4.17	3.86	4.26	**4.10**	3.85	4.23	4.21	**4.10**
Mean		**4.23**	**4.26**	**4.38**	**4.29**	**4.79**	**5.79**	**4.76**	**5.11**
S × C	S1	4.45	5.45	5.51	**5.14**	5.25	7.93	5.70	**6.29**
	S2	4.07	3.86	3.48	**3.80**	4.89	4.43	3.44	**4.25**
	S3	3.96	3.83	4.04	**3.94**	3.68	4.07	3.95	**3.90**
General Mean		**4.16**	**4.38**	**4.34**	**-**	**4.60**	**5.48**	**4.36**	**–**

	F_{test}	RLSD at $_{0.05}$	F_{test}	RLSD at $_{0.05}$
Planting date (D)	N.S	-	*	0.48
Seeding rate (S)	**	**0.46**	**	**0.53**
Cultivars (C)	N.S	-	*	0.58
D × S	N.S	-	N.S	-
D × C	N.S	-	N.S	-
S × C	*	1.03	*	1.02
D × S × C	N.S	-	N.S	-

*** and ** Significant at 0.05 and 0.01 levels of probability respectively and N.S nonsignificant**

Moreover, the data in **Table 2** showed that the seeding rate (S) had a significant effect ($p<0.05$)

on the leaf area index in only the second seasons. Decreasing seeding rate to 2 kg fed-1 (S1) led to a significant improvement in the leaf area index compared to increasing the seeding rate of 6 kg fed^{-1}. Seeding rate

(S1) recorded 5.14 and 6.29 cm in the first and second seasons, respectively, while the leaf area index decreased under (S3) seed rates, which recorded averages of 3.94 and 3.90 cm in the first and second seasons, respectively. The amount of increase in the leaf area index using (S1) reached about 14.7 and 45.8% compared to (S2) and (S3), respectively. The same results were obtained by ***Newton et al (2020),*** and ***Kandil and Shalabi (1985)*** where it was found that the relationship is inverse between seeding rate and leaf area index.

The results in **Table 2** indicate that the cultivars (C) had a significant effect on leaf area index in only the second seasons. The cultivar (C2) achieved the highest average values for this trait, reaching 4.38 and 5.48 cm in the first and second seasons, respectively. On the other hand, the lowest average values for this trait, reaching 4.34 and 4.36 cm in the first and second seasons, respectively were obtained from C3 cultivar. The amount of increase in the leaf area index from cultivation C2 cultivar reached about 12.46 and 13.24% compared to C1 and C3 cultivar, respectively. These differences are due to genetic differences among cultivars. **Newton et al (2020),** who confirmed the superiority of the Mombasa cultivar over the rest of the cultivars.

The data in **Table 2** emphasize that the first-order interaction between sowing date (D)×seeding rates (S) and sowing date (D)×cultivars (C) was not significant at 5% probability level in both seasons.

On the other hand, the first-order interaction between seeding rates (S)×cultivars (C) had a significant effect ($p<0.05$) on leaf area index in both growing seasons. The maximum leaf area index (5.45 and 7.93 cm in the two seasons, respectively) from (C2) cultivar when planting by seeding rate (S1). while the lowest leaf area index, 3.48 and 3.44 cm in the two seasons respectively, was obtained from (C3) cultivar when planting by seeding rate (S2). **Newton et al (2020)**, found in

terms of the inverse relationship between seeding rates, leaf area index, and superiority for the Mombasa variety.

The second-order interaction was not significant effect on the leaf area index in the two growing seasons.

II. Tillers height

The results shown in **Table 3** indicate that planting dates (D) had a significant effect ($p<0.05$) on the tillers height during the during the first and second growing seasons, respectively. Cultivation of panicum crop in the planting date (D1) led to a significant increase in the tillers height compared to planting date (D2) the amount of increase in the tillers height reached about 9.2% compared to planting date (D2). This is consistent with ***Mahmoud and Shaimaa (2020),*** who found that high tillage is affected by planting dates, and that the best planting date is in May due to the high tillage due to the availability of conditions associated with germination and growth, especially temperature, humidity, and lighting.

Table 3: means of tillers height (TH) cm, as affected by planting dates(D), seeding rates(S), cultivars (C), and their interactions in 2020/2021 and 2021/2022 seasons.

Season		2020/2021				2021/2022			
Planting date (D)	Seeding rate (S) kg/fad	Cultivars (C)			**Mean**	Cultivars (C)			**Mean**
		C1	C2	C3		C1	C2	C3	
D1	S1	134.76	141.38	143.17	**139.77**	130.01	144.01	142.51	**138.84**
	S2	148.52	142.72	154.92	**148.72**	153.33	140.26	171.71	**155.10**
	S3	157.29	160.04	159.58	**158.97**	168.89	171.26	159.90	**166.68**
Mean		**146.86**	**148.04**	**152.55**	**149.15**	**107.41**	**151.84**	**158.04**	**153.54**
D2	S1	126.59	121.84	121.03	**123.15**	127.57	138.32	137.18	**134.35**
	S2	127.11	134.44	127.02	**129.52**	145.18	135.87	159.35	**146.80**
	S3	135.65	137.73	146.54	**139.97**	158.43	159.62	155.80	**157.95**
Mean		**129.78**	**131.34**	**131.53**	**130.88**	**143.72**	**144.60**	**150.78**	**146.37**
S × C	S1	130.67	131.61	132.1	**131.46**	128.79	141.17	139.84	**136.60**
	S2	137.82	138.58	140.97	**139.12**	149.25	138.07	165.53	**150.95**
	S3	146.47	148.88	153.06	**149.47**	163.66	165.44	157.85	**162.32**
General Mean		**138.32**	**139.69**	**142.04**		**147.24**	**148.22**	**154.41**	

	F_{test}	RLSD at $_{0.05}$	F_{test}	RLSD at $_{0.05}$
sowing date (D)	**	3.12	*	6.40
Seeding rate (S)	**	3.82	**	7.10
Cultivars (C)	N.S	-	N.S	-
D × S	N.S	-	N.S	-
D × C	N.S	-	N.S	-
S × C	N.S	-	*	13.87
D × S × C	*	11.72	N.S	-

*** and ** Significant at 0.05 and 0.01 levels of probability respectively and N.S nonsignificant**

Moreover, the data in **Table 3** showed that the seeding rate (S) had a significant effect ($p<0.05$) on the tillers height in both seasons. High seeding rate to 6 kg fed-1 (S3) led to a significant improvement in the tillers height compared to the seeding rate of 2 kg fed^{1}-. Seeding rate (S3) recorded 153.1 and 162.32 cm in the first and second seasons, respectively, while the tillers height decreased under (S1) seed rates, which recorded averages of 131.46 and 136.60 cm in the first and second seasons, respectively. The amount of increase in the tillers height using (S3) reached about 16.3 and 7.5% compared to (S1) and (S2), respectively. which confirms the

uniformity of the high seeding rate (S3) for this trait the superiority is due to the high seeding rate (S3) in tillers height to the crowding in the number of panicum crop plants contributes to the tillers height this is consistent with what was found by ***Kandil and Shalabi (1985),*** who confirmed that increasing the seeding rate led to a gradual increase in tillers height.

The results in **Table 3** indicate that the cultivars (C) had not a significant effect on tillers height in both seasons.

The data in **Table 3** emphasize that the first-order interaction between sowing date (D)×seeding rates (S) and sowing date (D)×cultivars (C) was not significant at 5% probability level in both seasons.

On the other hand, the first-order interaction between seeding rates (S)×cultivars (C) had a significant effect on tillers height in the second season only. The maximum tillers height (153.06) in the first season from (C3) cultivar when planting by seeding rate (S3) and (165.44cm) in the second season was obtained from (C2) cultivar when planting by seeding rate (S3). while the lowest tillers height, 130.67 and 128.79cm in the two seasons respectively, was obtained from (C1) cultivar when planting by seeding rate (S1). The significant effect that appeared in the second season and the superiority of cultivar (C3) confirms what was found by ***Michael et al (2014),*** but with lower seed rates.

The second-order interaction had a significant effect on the tiller height in the first season only. The highest value (160.04cm) in the first season was obtained from the interaction among C2 × S3 ×D1, and in the second season highest value (171.71cm) was obtained from the interaction among C3 × S2 × D1. On the other hand, the lowest value (121.03 cm) in the first season was obtained from the interaction among C3 × S1 × D2, lowest value in the second season (127.57) was

obtained from the interaction among C1 × S1 × D2. this is confirmed by Azza et al (2019), he found that sowing dates are the main factor in causing changes in the results of tillers height when overlapping between (C × S × D), and also confirms what he found. This is consistent with ***Mahmoud and Shaimaa (2020)***, who found that high tillage is affected by sowing dates, and that the best sowing date is in May due to the high tillage due to the availability of conditions associated with germination and growth.

III. Number of tillers m^{-2}

The results shown in Table 4 indicate that sowing dates (D) had not a significant effect on the number of tillers during the during the first and second growing seasons, respectively.

Table 4: means of number of tillers (NT) m^{-2}, as affected by planting dates(D), seeding rates(S), cultivars (C), and their interactions in 2020/2021 and 2021/2022 seasons.

Season		2020/2021				2021/2022			
Planting date (D)	Seed-ing rate (S) kg/fad	Cultivars (C)			**Mean**	Cultivars (C)			**Mean**
		C1	C2	C3		C1	C2	C3	
D1	S1	242.88	220.63	313.38	**258.96**	184.88	155.00	276.00	**205.29**
	S2	290.50	278.38	405.75	**324.88**	237.25	234.75	386.88	**286.29**
	S3	376.63	327.13	320.63	**341.46**	364.88	298.50	287.38	**316.92**
Mean		**303.33**	**275.38**	**346.58**	**308.43**	**262.33**	**229.42**	**316.75**	**269.50**
D2	S1	250.36	244.00	313.30	**269.22**	185.25	158.25	263.13	**202.21**
	S2	303.18	299.70	361.09	**321.32**	234.63	225.38	343.75	**267.92**
	S3	339.52	304.70	314.52	**319.58**	342.75	287.50	273.25	**301.17**
Mean		**297.68**	**282.80**	**329.64**	**303.37**	**254.21**	**223.71**	**293.38**	**257.10**
S × C	S1	246.62	232.31	313.34	**264.09**	185.06	156.63	269.56	**203.75**
	S2	296.84	289.04	383.42	**323.10**	235.94	230.06	365.31	**277.10**
	S3	358.07	315.91	317.57	**330.52**	353.81	293.00	280.31	**309.04**
General Mean		**300.51**	**279.09**	**338.11**		**258.27**	**226.56**	**305.06**	

	F_{test}	RLSD at $_{0.05}$	F_{test}	RLSD at $_{0.05}$
sowing date (D)	N.S	-	N.S	-
Seeding rate (S)	**	20.05	*	32.73
Cultivars (C)	**	20.33	**	33.75
D × S	N.S	-	N.S	-
D × C	N.S	-	N.S	-
S × C	*	33.86	*	60.67
D × S × C	*	47.88	N.S	-

*** and ** Significant at 0.05 and 0.01 levels of probability respectively and N.S nonsignificant**

Moreover, the data in **Table 4** showed that the seeding rate (S) had a significant effect ($p<0.05$) on the number of tillers in both seasons. High seeding rate to 6 kg fed-1 (S3) led to a significant improvement in the number of tillers compared to the seeding rate of 2 kg fed-1. Seeding rate (S3) recorded 330.52 and 309.04 in the first and second seasons, respectively, while the number of tillers decreased under (S1) seed rates, which recorded averages of 264.09 and 203.75 in the first and second seasons, respectively. The amount of increase in the number of

tillers using (S3) reached about 36.7 and 6.6% compared to (S1) and (S2), respectively. This is consistent with ***Michael et al. (2014),*** who found that a high seeding rate (S3) contributes to increasing the number of tillers and causing crowding in the number of panicum crop plants, which leads to an increase in the number of tillers per unit area.

The results in **Table 4** indicate that the cultivars (C) had a significant effect ($p<0.05$) on number of tillers in both seasons. the cultivar (C3) achieved the highest average values for this trait, reaching 338.11 and 305.06 in the first and second seasons, respectively. On the other hand, the lowest average values for this trait, reaching 279.09 and 226.56 in the first and second seasons, respectively were obtained from (C2) cultivar .The amount of increase in the number of tillers from Cultivation (C3) cultivar reached about 15.10 and 27.20% compared to (C1) and (C2) cultivar, respectively. The superiority of the third cultivar (C3) over the rest of the tested cultivars in terms of the number of tillers m² meter is attributed to the differences between the cultivars (C)in genetic composition and the interaction between the genetic makeup and the prevailing environmental conditions, as these conditions were more consistent with the third cultivar than with the rest of the cultivars. Ramakrishnan et al (2016), which indicated that there are significant differences (difference) between cultivars (C) in the number of tillers m².

The data in Table 5 emphasize that the first-order interaction between sowing date (D)×seeding rates (S) and sowing date (D) × cultivars (C) was not significant at 5% probability level in both seasons.

On the other hand, the first-order interaction between seeding rates (S)×cultivars (C) had a significant effect ($p<0.05$) on number of tillers in both seasons. The maximum number of tillers (358.07) in the first seasons from (C1)

cultivar when planting by seeding rate (S3), and)365.31(in the second seasons, from (C3) cultivar when planting by seeding rate (S2). while the lowest tillers height, 232.31 and 156.63 in the two seasons respectively, was obtained from (C2) cultivar when planting by seeding rate (S1). This is consistent with ***Michael et al (2014),*** which demonstrated superiority at high seeding rate (S) even with the same cultivars.

The second-order interaction had a significant effect on the number of tillers in the first season only. The highest value 405.75 and 386.88 in both seasons was obtained from the interaction among C3 × S2 × D1, on the other hand, the lowest value 220.63 and 155 in both seasons was obtained from the interaction among C2 × S1 × D1. This means that cultivars and seed rates are among the most important determinants of the number of tillers, this confirms what ***Hussein and Nadhum (2020), and Michael et al (2014),*** found.

The data in **Table 4** emphasizes that the first-order interaction between planting date (D) × seeding rates (S) and planting date (D) × cultivars (C) were not significant at 5% probability level in both seasons.

IV. Leaf stem ratio

The results shown in **Table 5** indicate that sowing dates (D) had a significant effect on the leaf stem ratio during the during the first only growing seasons, respectively. In any case cultivation of panicum crop in the sowing date (D2) led to a significant increase in the leaf stem ratio compared to sowing date (D1) the amount of increase in the leaf stem ratio reached about 37.2 and 6.44 % in the first and second seasons, respectively compared to sowing date (D1). this is what ***Abdalrady et al (2017)*** found, ***Bakheit et al (2021)***, the late sowing date produced the highest average leaf stem ratio, which contributed to producing the highest value of the dry fodder crop.

Table 5: means of leaf stem ratio (LSR), as affected by planting dates(D), seeding rates(S), cultivars (C), and their interactions in 2020/2021 and 2021/2022 seasons.

Season		2020/2021				2021/2022			
Planting date (D)	Seed-ing rate (S) kg/fad	Cultivars (C)			**Mean**	Cultivars (C)			**Mean**
		C1	C2	C3		C1	C2	C3	
D1	S1	91.76	74.05	88.90	**84.90**	79.11	65.41	76.06	**73.53**
	S2	82.87	78.55	75.86	**79.09**	66.51	57.78	53.53	**59.27**
	S3	69.92	74.11	65.13	**69.72**	49.12	61.39	47.18	**52.56**
Mean		**81.51**	**75.57**	**76.63**	**77.90**	**38.54**	**61.53**	**58.92**	**61.79**
D2	S1	141.98	100.57	88.70	**110.42**	79.33	66.15	78.30	**74.59**
	S2	96.23	102.48	127.39	**108.70**	69.81	64.18	60.49	**64.83**
	S3	96.29	115.42	93.14	**101.62**	57.27	63.38	52.98	**57.88**
Mean		**111.50**	**106.16**	**103.08**	**106.91**	**68.81**	**64.57**	**63.92**	**65.77**
S × C	S1	116.87	87.31	88.80	**97.66**	79.22	65.78	77.18	**74.06**
	S2	89.55	90.51	101.63	**93.90**	68.16	60.98	57.01	**62.05**
	S3	83.11	94.77	79.13	**85.67**	53.19	62.39	50.08	**55.22**
General Mean		**96.51**	**90.86**	**89.85**		**66.86**	**63.05**	**61.42**	

	F_{test}	RLSD at $_{0.05}$	F_{test}	RLSD at $_{0.05}$
sowing date (D)	**	4.57	N.S	-
Seeding rate (S)	*	6.08	*	8.88
Cultivars (C)	N.S	-	N.S	-
D × S	N.S	-	N.S	-
D × C	N.S	-	N.S	-
S × C	**	10.19	N.S	-
D × S × C	**	14.66	N.S	-

*** and ** Significant at 0.05 and 0.01 levels of probability respectively and N.S nonsignificant**

Moreover, the data in **Table 5** showed that the seeding rate (S) had a significant effect ($p<0.05$) on the leaf stem ratio in both seasons. seeding rate to 2kg fed^{-1} (S1) led to a significant improvement in the leaf stem ratio compared to the seeding rate of 6 kg fed^{-1}. Seeding rate (S1) recorded 97.66 and 74.06 in the first and second seasons, respectively, while the leaf stem ratio decreased under (S1) seed rates, which recorded averages of 85.67 and 55.22 in the first and second seasons, respectively. The amount of increase in the leaf stem ratio using (S1) reached about 10.1and 21.9% compared to (S2) and (S3), respectively. this what found ***Azza et al (2019),*** they there is an inverse relationship between seed rates and leaf stem ratio, as lower seed rates result in a higher leaf stem ratio and vice versa.

The results in **Table 5** indicate that the cultivars (C) had a not significant effect on leaf stem ratio in two seasons.

The data in **Table 5** emphasize that the first-order interaction between sowing date (D)×seeding rates (S) and sowing date (D)×cultivars (C) was not significant at 5% probability level in both seasons.

On the other hand, the first-order interaction between seeding rates (S)×cultivars (C) had a significant effect on leaf stem ratio in the season Only the first, the maximum leaf stem ratio 116.87 and 79.22 in the seasons respectively from (C1) cultivar when planting by seeding rate (S1). while the lowest leaf stem ratio, 79.13 and 50.08 in the two seasons respectively, was obtained from (C3) cultivar when planting by seeding rate (S3). this is what he found, ***Abdalrady et al (2017), Azza et al (2019)***.

The second-order interaction had a significant effect on the leaf stem ratio in the first season only. The highest value 141.98 and 79.33 in both seasons was obtained from the interaction among C1 × S1 × D2, on the other hand, the lowest value 65.13 and 49.12 in both seasons was obtained from the interaction among C3 × S3 × D1. This is what he found, ***Abdalrady et al (2017) and Azza (2019).***

CONCLUSION

Panicum can be planted on the planting date of 25/05 with seed rates of 2 kg per acre for any of the cultivars on which the study was conducted.

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