International Science and Technology Journal
المجلة الدولية للعلوم والتقنية

Volume 36 العدد
Part 1 المجلد

http://www.doi.org/10.62341/msfr1004

Received	2025/02/28	تم استلام الورقة العلمية في
Accepted	2025/03/26	تم قبول الورقة العلمية في
Published	2025/03/28	تم نشر الورقة العلمية في

Response Yield and Forage Quality of *Panicum Maximum* to Nitrogen Fertilization Rates under Saline Water Conditions in Tobruk Area-Libya

Mohammed Naji Husayn[1], Saleh A. Abugarsa[2], *Fatma A. Farag[3]
[1]Faculty of Natural Resources and Ecology Sciences
Tobruk University-Libya
[2]Faculty of Natural Resources and Ecology Sciences
Omar Al-Mukhtar University-Libya
[3]Faculty of Agriculture, Omar Al-Mukhtar University-Libya
*Fatmaalzhra84@yahoo.com

Abstract:

A field experiment was conducted in summer 2022 in the Haflz area, about 70 km east of Tobruk city to study the effect of saline irrigation water and rates of nitrogen fertilization on the growth, yield, and forage quality of the *Panicum maximum*. The experiment was implemented in split –block design with randomized complete block design (RCBD). Irrigation water saline concentrations represented the main factor, (control, 120, 5000, and 12000 ppm). Nitrogen fertilization levels in the form of urea N46% represented the secondary factor, (without fertilization, 100 and 200 kg N/ha). The results of variance analysis indicated that, showed significant differences ($p<0.05$) in the effect of nitrogen fertilizations rates on all plant traits, as the nitrogen fertilization rate of 200 kg/h outperformed the rest of the fertilization levels in a direct relationship, meaning that the traits increased linearly with an increase in nitrogen fertilization rate for all growth stages. The analysis results indicated significant differences ($p<0.05$) with the interaction effects between irrigation water salinity and nitrogen fertilization rates in all studied traits, where the combination of 120 ppm with 200 kg/ha exceeded the other treatments, while the combination of 12000 ppm with 0 kg/ha recorded the lowest averages for all studied traits. The study concluded that the resistance of panicum plants to irrigation with saline water improves utilizing nitrogen fertilization.

Keywords: Panicum yield, irrigation water salinity, nitrogen fertilization rates.

http://www.doi.org/10.62341/msfr1004

استجابة محصول وجودة العلف لنبات البونيكام (*Panicum maximum* cv. Mombasa) لمعدلات التسميد النيتروجيني على تحت ظروف المياه المالحة بمنطقة طبرق – ليبيا

[1]محمد ناجي طاهر، [2]صالح عطية بوغرسة، [3]فاطمة فرج محمد

1- كلية الموارد الطبيعية وعلوم البيئة، جامعة طبرق- ليبيا

2- كلية الموارد الطبيعية وعلوم البيئة، جامعة عمر المختار- ليبيا

3- كلية الزراعة، جامعة عمر المختار- ليبيا

الملخص

اقيمت تجربة حقلية في صــيف (2022) بمنطقة حفلز شـرق مدينة طبرق بحوالي 70 كيلومتر لدراســة تأثير المياه الر ي المالحة ومعدلات التســميد النيتروجيني على النمو والمحصـول وجودة نبات البونيكام. نفذت التجربة بتصـميم القطاعات المنشـقة مرة واحدة split-plot design بقطاعات كاملة العشــوائية RCBD مثلت تركيزات ملوحة مياه الري العامل الرئيســي) الشــاهد،120، 5000 ، 12000 ppm) ومثلت مســتويات التسميد النيتروجيني على هيئة يوريا 46%N العامل الثانوي بدون تسميد، 100 ، 200 كجم N /هكتار. اشـارت نتائج التحليل التباين الي وجود فروق معنوية (P>0.05) في تأثيرات المياه المالحة على النبات في جميع الصفات المدروسة حاصل العلف الرطب /الجا ف طن/هكتار / حاصل البروتين الخام طن/هكتار / نسبة البروتين % ونسبة النيتروجين% والفسفور %والبوتاسيوم % في النبات / نسبة البروتين في البذور وكانت الصـفات تقل تدريجيا بزيادة نسـبة ملوحة مياه الري أي بعلاقة عكسـية كلما زادت نسـبة الملوحة قلت الصــفات المدروســة. كما اظهرت نتائج التحليل التباين الى فروق معنوية (P>0.05) في تأثير معدلات التســميد النيتروجيني على النبات في جميع الصــفات المدروسة حيث تفوق معدل التسميد ال نيتروجيني200 كجم/هكتار على باقي مستويات التســميد بعلاقة طردية أي انه تزيد الصــفات خطيا بزيادة معدل التســميد النيتروجيني لجميع مراحل النمو. اشـــارت نتائج تحليل التباين الى فروقات معنوية (P>0.05) مع تأثيرات التداخل بين ملوحة مياه الري ومعدلات التسـميد النيتروجيني في جميع الصـفات المدروسـة حيث تفوقت توليفة 120 ppm مع 200 كجم/هكتار على جميع المعاملات

الأخرى، بينما ســـجلت توليفة ppm 12000مع 0كجم/هكتار اقل متوســـطات لجميع الصـــفات المدروســـة، وتوصـــلت الدراســـة بان مقاومة نبات البونيكام لملوحة مياه الري تتحسن باستخدام التسميد النيتروجيني.

الكلمات المفتاحية: محصول البونيكام، ملوحة مياه الري، معدلات التسميد النيتروجيني

Introduction:

(*Panicum maximum*) is a forage plant of great economic value and has been introduced to many tropical countries as a source of animal feed. Over the past decade, it has been introduced in the arid northern regions of Africa (Morocco, Algeria, Tunisia, Libya and Egypt). In Addition to its ability to provide nutrient – rich fodder, it has the ability to resist salinity stress and grows well in arid and semi – arid, suitable for feeding many grazing animals (Benabderrahim and Elfalleh, 2021). it is considered one of the best types of fodder and has the ability to produce good quality leaves (Corsi and Santos, 1995). The crude protein content of fresh panicum ranges from 6.7 to 21.6% (Hare *et al*.,2013). It can tolerate continuous heavy grazing for long periods under heavy annual rainfall, performs best in moderate shade (Bonfim-Silva *et al*., 2022). It produces a high yield of palatable fodder and responds well to fertilization, as this type is characterized by being a perennial plant that continues to produce for up to 10 years. It is worth noting that the productivity of the Panicum is three times of alfalfa and is more tolerant of salinity. Libya is one of the Arab countries that suffers from drought, as it faces an increasing water crisis due to the scarcity of water resources, as well as the increasing population and excessive water consumption (Aldomi, 2000).

Libya is one of the Arab countries suffering from drought, and it faces a severe water crisis due to the scarcity of water resources, as well as the increase in population and consumption (Al-Domi, 2000). Approximately 95% of the extreme areas in the Melbourne periphery were affected. Furthermore, there is little that can be achieved in Libya that can be relied upon to provide a limited amount of water and reduce the pressure on the world's limited water resources (Abu Ghaleila & Walata, 2013). The Tobruk region is located in a semi-arid area in a fragile environment with poor soil, scarce surface water, and scarce rainfall. Average rainfall is approximately 180.6 mm/year. Dissolved salt content in most groundwater aquifers is high, ranging from 1,620 to 6,656 parts per

http://www.doi.org/10.62341/msfr1004

million, making them unfit for human consumption and exacerbating the water crisis in the region (Al-Obaidi,2015)

Given the lack of sufficient fresh water to increase the rate of agricultural expansion to the desired level, it was necessary to utilize water of different qualities and varying levels of salinity, such as groundwater, to ensure continued production and prevent land degradation under these conditions (Rhoades and Dinar, 1991). Studies conducted by a number of researchers (Hamdy, 1998) and (Miles) demonstrated the possibility of using saline water for irrigation, especially when rainfall is around 200 mm. This study aims to determine the possibility of growing the panicum crop in the Batnan region, the extent of its adaptation to the environment, and its ability to germinate and grow under the influence of different levels of irrigation water salinity and different levels of nitrogen fertilization.

Materials and research methods

Geographical location of the study area:

The study area (Haflaz) is located approximately 70 km east of Tobruk city (Libya). Bordered to the north by the Kambut area, to the south by the Al-Shu'bah and Omar Al-Mukhtar areas, to the east by the Al-Gharabat and Bir Al-Ashhab area, and to the west by Al-Qa'ara and Omar Al-Mukhtar areas, as shown in Figure (1). The study area is between latitude and longitude 24.473607° East and 31.837346°N, at an altitude of 134 meters above sea level, The climate of the study area is characterized as a desert climate and is affected by the influences of the Mediterranean Sea in temperature and thus in all other climate elements. Table (1) shows some of the temperatures recorded in the region from 1985-2007.

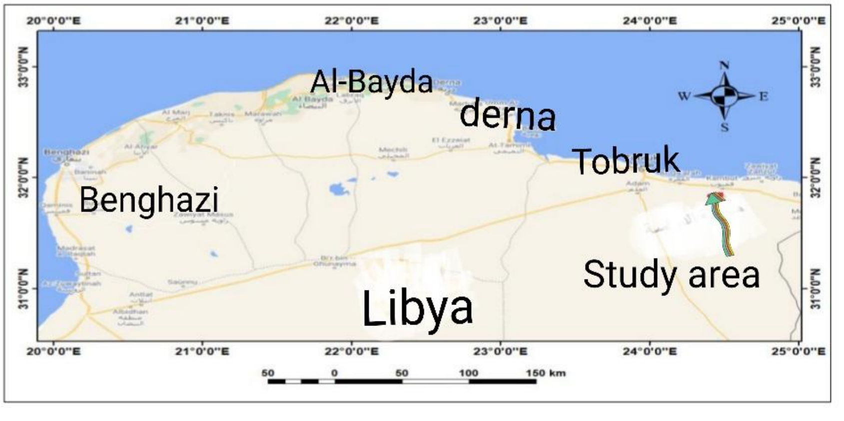

Figure 1. Study area

http://www.doi.org/10.62341/msfr1004

Table (1): Monthly averages of temperatures from the period

Month	Average temperature			
	Max	Min	Diurnal temperature Variation	Mean
May	24.9	16.5	8.4	20.7
June	27.6	19.9	7.7	23.7
July	29.0	22.3	6.7	25.6
August	29.7	23.3	6.4	26.5
September	29.2	21.9	7.3	25.5
Mean	28.08	20.78	7.3	24.4

Source: Tobruk meteorological station

Study Methodology

A field experiment was conducted in the summer of 2022 in the Hafez area using a Randomized Complete Block Design (RCBD) with three replicates. A soil sample was taken at a depth of 30 cm before the experiment began and analyzed as shown in Table.(2) . The experimental land was then prepared by plowing and leveling. The experiment was implemented using two factors, each with three levels. The first factor was the salinity concentration of the irrigation water (120 (control group), 5,000, and 12,000 ppm), as shown in Table (3), The second factor was three levels of nitrogen fertilization in the form of urea (46% N) (0-100- and 200 kg/ha), a total of 9 treatments * 3 blocks = 27 experimental units. The experimental unit area was 9 square meters (3m × 3m), with a distance of 3 meters between blocks. Seedlings were planted 50 cm apart, according to the recommendations of Al-Eissawi (2019). Each experimental unit contained 25 seedlings, 30 days old, according to the recommendations of Mubarak and Al-Shammari, 2019. Planting took place on June 15, 2022. Urea was fertilized twice: once at the beginning of the experiment and again 45 days later, with measurements taken 90 days after planting.

Table (2) Some physical and chemical properties of the experimental soil

No	Type of analysis	unit	ppm 120	5000ppm	12000ppm
1	TDS	ppm	120	5000	12000
2	pH	PH	6.6	7.6	7.9
3	EC	ppm	187	7523	18456
4	Ca+2	Mg/L	121	671	1123
5	Mg+2	Mg/L	23	19	322
6	HCO3-	Mg/L	64	492	2141
7	CL-	Mg/L	44	1102	2533

http://www.doi.org/10.62341/msfr1004

8	K+	Mg/L	0.8	68.3	284
9	Na+	Mg/L	115	962	1745

Table (3) Some chemical properties of irrigation water used in the experiment

No	Type of analysis	Unit	Results
1	Conductivity	us/cm	6195
2	Total dissolved salt	Ppm	4151
3	pH	pH	7.9
4	Total Hardness	Mg/L	739.3
5	Chloride	Mg/L	679.4
6	Calcium	Mg/L	622.6
7	Magnesium	Mg/L	116.7
8	Sodium	Mg/L	593.0
9	Potassium	%	0.156
10	Total Nitrogen	%	0.247
11	Total phosphorus	%	0.167
12	Soil texture	%	Sandy loam

Studied attributes:

1- Wet fodder yield (tons/ha).

Plants were mowed with an area of (0.5 m2) at a height of 10-15 cm from the soil surface from each experimental unit, the green fodder yield was weighed immediately after mowing to ensure no loss of moisture due to evaporation, and on the basis of that, the green fodder yield was calculated.(رضوان والفخري، 1976)

2- Dry fodder yield (tons/ha)

The plants were dried in an oven at 70 degrees for 72 hours until the weight was stable, the dry weight was calculated based on the following equation:

Dry matter yield = green fodder yield × percentage of dry matter (Braz *et al*., 2017).

3- Crude protein yield (tons/ha)

Crude protein yield was calculated according to the following equation:

Crude protein yield = material yield × percentage of crude protein (Braz *et al*., 2017).

4- Percentage of protein in plants (%)

The percentage of crude protein was estimated by the semi-micro kieldal method according to A.O.A.C (1980) according to the equation:

http://www.doi.org/10.62341/msfr1004

Protein percentage = Nitrogen percentage × 6.25

5- Protein content in seeds (%)

The percentage of protein was estimated by the semi-micro kieldal method according to A.O.A.C (1980).

Protein percentage = Nitrogen percentage x 6.25

6- Percentage of nitrogen in the plant (%)

Nitrogen in the plant was estimated using the Kjeldahl Apparatus. This was done by taking 10 ml of the digested sample and adding 10 ml of sodium hydroxide (NaOH), a concentration of 40%. Then the distillation process was carried out, after which the liberated ammonia was collected in a glass beaker containing 20 ml of boric acid, concentration 2%. And a mixture of Methyl Red and Green Bromocresol, then pulverized Ammonia collected with hydrochloric acid (HCl), and knowing the amount of acid removed, then calculating the total nitrogen(الصحاف، 1989) .

7- Percentage of phosphorus in plants (%)

The percentage of phosphorus in the leaves was estimated in the laboratory using ascorbic acid and ammonium molybdate, and using a visible-UV spectrophotometer at a wavelength of 620 nm. (الصحاف، 1989)

8- Percentage of potassium in plants (%)

Potassium in plant leaves was determined by Flame Photometer (Haynes, 1980).

Statistical analysis

The data were statistically analysed according to the analysis of variance method for each trait using the Genstat analysis program, and the arithmetic means were compared using the least significant difference (L.S.D) method at a 5% significance level (Steel and Torri, 1980).

Results and discussion

1.Wet fodder yield (tons/ha)

The results as shown in Table (4), indicated that there were highly significant differences due to the effect of saline water, nitrogen fertilization rates and the interaction between them on the wet fodder yield, with an inverse relationship, yields decreased with increasing irrigation water salinity, with a concentration of 120 ppm yielding the highest average of 31.06 t/ha. Forage production

http://www.doi.org/10.62341/msfr1004

decreased to 19.60 t/ha when irrigation water salinity increased by 5,000 ppm and to 14.52 t/ha when irrigation water salinity increased to 12,000 ppm. This may be due to the fact that saline water contains high concentrations of salt and other ions, which can affect plant growth and reduce water use efficiency, which in turn affects crop yields. (Elsiddig *et al*., 2022), who attributed the reason for this to the fact that salty water contains high concentrations of salt and other ions, which can affect the plant growth process and reduce the efficiency of water use, which is reflected in the crop. The results also showed that nitrogen fertilization rates have a positive effect with a direct relationship, meaning that a higher nitrogen fertilization rate leads to greater wet fodder yield. The fertilization rate of 200 kg/ha gave the highest averages of 28.30 tons/ha, while the 0 kg/ha rate gave the lowest averages of 14.81 tons/ ha. The reason for this may be attributed to the fact that using 200 kg/ha worked to provide nitrogen in the soil, gave the plant the opportunity to absorb it, increase the size and number of cells, stimulate the plant to grow, increase the number of leaves and stems, plant height, and increase in biomass, this is reflected in the amount of the crop. It is in harmony with the results of (Peixoto *et al*., 2010) who pointed out that fertilization increases the quantity of the trait and improves the quality and thus increases the fodder yield. The plant response to water salinity differed significantly according to the nitrogen fertilization rates and its effect on the wet fodder yield. The combination of water at a concentration of 120 ppm and nitrogen fertilization rate of 200 kg/ha gave the highest averages for the wet fodder yield (42.63 tons/ha), while the lowest average (11.00 tons/ha) was obtained by the combination of irrigation water at concentration of 12000 ppm and 0 kg /ha Figure (2). This is consistent with (Rodrigues *et al*., 2017) who indicated that nitrogen fertilization reduces plant salt stress by increasing plant growth and its ability to tolerate salinity, improving crop production, and high production of leaves, shoots and stems, which positively reflected in the fodder yield.

Table 4. The effect of salt water and nitrogen fertilization rates and their interaction on wet fodder yield (tons/ha)

NFR / Saltwater	200 kg/ ha	100kg/ ha	0 kg/ ha	Mean
ppm 120	42.63a	31.23b	19.30e	31.06a
ppm 5000	23.50c	21.17d	14.13f	19.60b
ppm 12000	18.77e	13.80f	11.00j	14.52c
Mean	28.30a	22.07b	14.81c	21.73

http://www.doi.org/10.62341/msfr1004

LSD 5%	salinity × nitrogen	Nitrogen	Salinity	
	2.508	1.460	1.943	

Means with similar letters have no significant differences , Means with different letters have significant differences , NFR = Nitrogen Fertilization Rates

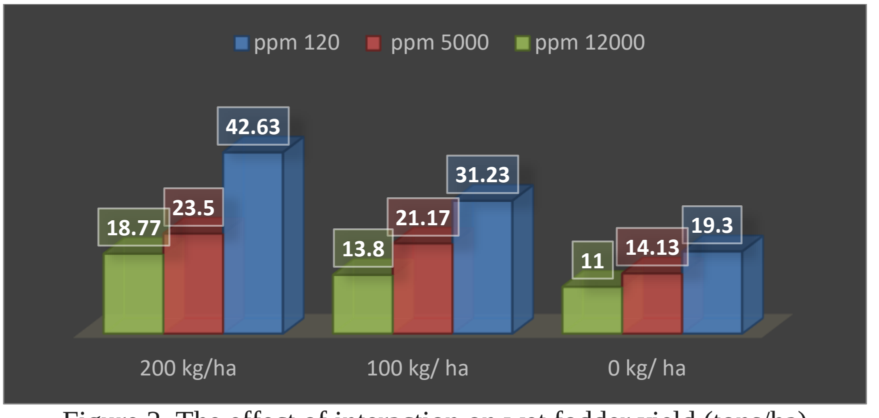

Figure 2. The effect of interaction on wet fodder yield (tons/ha)

2- Protein yield (kg/ha)

The results of the variance analysis indicated that there were highly significant differences between the parameters for the protein yield as a result of salt water, nitrogen fertilization rates, and the interaction between them, as shown in Table (5), was negative with an inverse relationship, meaning that the trait decreases as the concentration of salts in the irrigation water increases. Water of 120 ppm gave the highest average of 1562 kg/ha, while salinity of 12000 ppm gave the lowest average of 651 kg/ha. This is consistent with (Ali *et al.*, 2021), who attributed the reason for this to the fact that salty water contains high concentrations of salt and other toxic ions for plants, which affects plant growth, the increase in biomass and the amount of nitrogen in the plant reflected on protein yield. The same table shows that nitrogen fertilization rates have a positive effect with a direct relationship, meaning that higher nitrogen fertilization rate achieved higher protein yield. Nitrogen fertilization rate of 200 kg/ha recorded the highest averages for the trait, amounting to 1445 kg/ha, the 100 kg/ha fertilization rate gave 1042 kg/ha, while 0 kg/ha gave the lowest average 624 kg/h. The reason for this may be attributed to the fact that increasing the amount of nitrogen in the soil makes it available to the plant and thus the ability to absorb it, which has an effect on increasing the size and number of cells, stimulating plant growth,

http://www.doi.org/10.62341/msfr1004

increasing the number of leaves and stems, and thus increasing the percentage of protein. This is compatible with (Almodovar *et al*., 2008) and (Paciullo *et al*., 2016) who reported that nitrogen is one of the basic elements that plants need for growth and development, as it is involved in the synthesis of proteins, DNA, chlorophyll, and other vital compounds. When plants are exposed to nitrogen fertilization, nitrogen is absorbed from the soil by the roots and turns into nitrate ions, which are transmitted through the plant tissues to the leaves and other parts of the plant, increasing the biomass of the crop and the percentage of nitrogen, thus increasing the protein yield. The plant's response to water salinity differed according to the fertilization rates. The plant's response to water salinity differed according to the fertilization rates. There was a highly significant difference in the quality of protein yield. As shown in Figure (3) the combination between saline water at a concentration of 120 ppm and a nitrogen fertilization rate of 200 kg/ha gave the highest averages for protein yield, while the combination between salinity at a concentration of 12000 ppm and 0 kg/ha gave the lowest averages. This is consistent with the results of (Thongruang *et al*., 2020) and (Rodrigues *et al*., 2017), where it was found that when applying increasing doses of nitrogen led to a linear increase in protein content, this was attributed to the fact that nitrogen constitutes an essential part of the amino acids that make up Proteins in plants, increase the amount of biomass which affects protein yield.

Table 5. The effect of salt water, nitrogen fertilization rates, and their interaction on protein yield (kg/ha)

NFR / Salt water	200 kg/ha	100 kg/ ha	0 kg/ ha	Mean
ppm 120	2249a	1589b	848d	1562a
ppm 5000	1166b	947d	585e	899b
ppm 12000	922 c	591e	440e	651c
Mean	1445	1042	624	1037
LSD 5%	salinity×nitrogen	Nitrogen	Salinity	
	165.2	113.6	61.1	

Means with similar letters have no significant differences, means with different letters have significant differences, NFR = Nitrogen Fertilization Rates

http://www.doi.org/10.62341/msfr1004

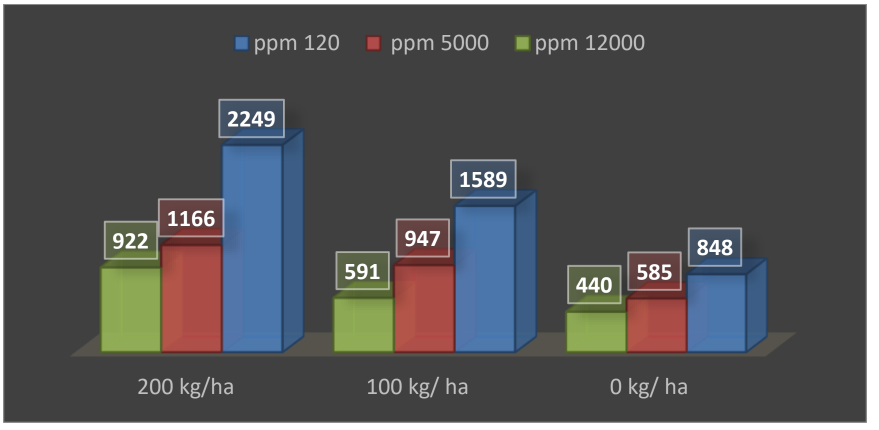

Figure 3. The effect of interaction on protein yield (kg/ha)

3. Protein percentage (%)

The results in Table (6) showed significant differences between the treatments for the protein percentage in the plant due to the influence of salt water, and highly significant effects between the rates of nitrogen fertilization and the interaction between them, as the effect of salt water varied among them on the protein percentage in the plant.

Table 6. The effect of salt water, nitrogen fertilization rates, and their interaction on Protein percentage (%)

N.F.R / Water salinity	200 kg/ha	100 kg/ha	0 kg / ha	Mean
ppm 120	11.433a	11.033b	9.567e	10.678a
ppm 5000	10.567c	10.067d	9.533e	10.056b
ppm 12000	10.633c	10.133d	9.300f	10.022c
Mean	10.878a	10.411b	9.467c	10.252
LSD 5%	salinity× nitrogen	nitrogen	Salinity	
	0.2130	0.0938	0.2038	

Means with similar letters have no significant differences; means with different letters have significant differences

The characteristic decreases as the percentage of salinity in irrigation water increases, which indicates the existence of an inverse relationship, as salinity of 120 ppm gave the highest averages of 10.678%, while it decreased to 10.022% at 12000 ppm The reason for this may be due to the salt stress of the plant, and this is consistent with the results of (Ali *et al*., 2021), who

http://www.doi.org/10.62341/msfr1004

attributed the reason for this to the fact that salty water contains high concentrations of salt and other toxic ions which affect the production of nitrogen in the plant, this has been reflected in the total amount of protein in the plant. As shown in Figure (4) the combination between saline water at a concentration of 120 ppm and a nitrogen fertilization rate of 200 kg/ha gave the highest averages for Protein percentage (%), while the combination between salinity at a concentration of 12000 ppm and 0 kg/ha gave the lowest averages.

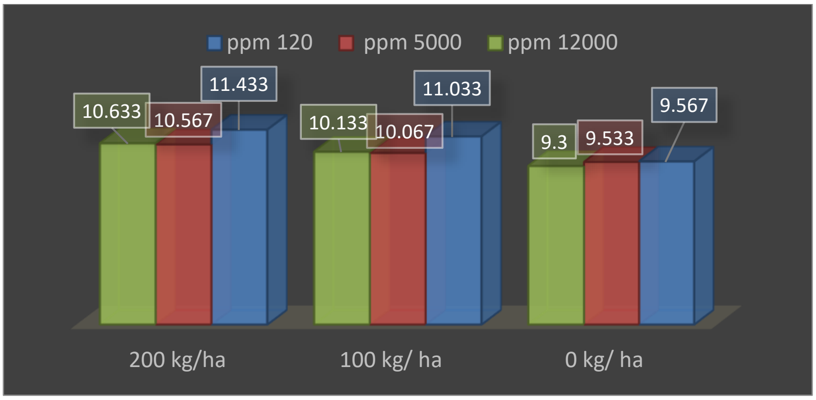

Figure 4. The effect of their interaction on Protein percentage (%)

4. Protein percentage in seeds

The results in Table (7) showed significant differences between the treatments for the protein in seeds due to the influence of salt water 120 ppm gave the highest average for the trait, amounting to 17.244%, and it decreased to 16.889% at a salinity of 5000 ppm, while salinity at 12,000 ppm gave the lowest average at 16.378%.

Table 7. The effect of salt water, nitrogen fertilization rates, and their interaction on the protein content in seeds

NFR / Water salinity	200 kg / ha	100 kg / ha	0 kg / ha	Mean
ppm 120	17.933 a	17.667 ab	16.133 cd	17.244a
ppm 5000	17.800 a	17.233 bc	15.633 d	16.889b
ppm 12000	17.733 ab	16.700 c	14.700 e	16.378c
Mean	17.822 a	17.200 b	15.489 c	16.837
LSD 5%	salinity×nitrogen	nitrogen	salinity	
	0.5825	0.3956	0.2538	

Means with similar letters have no significant differences, Means with different letters have significant differences

http://www.doi.org/10.62341/msfr1004

The reason may be due to salt stress, this is consistent with the results of (Wardany *et al*., 2022). The reason for this was attributed to the fact that salty water contains high concentrations of salt and other ions, which can affect the plant growth process and reduce the efficiency of using water and nutrients, therefore affecting nitrogen and thus the protein percentage in the seeds. The table also shows that nitrogen fertilization rates have a significant effect on the percentage of protein in seeds, as the fertilization rate of 200 kg/ha gave the highest average of 17.822%, while the fertilization rate of 100 kg/ha gave the average of 17.20%, whereas the rate of 0 kg/ha gave the lowest average for the trait, amounting to 15.489 %. This agree with the results of (فرج و جدوع، 2015) Who attributed the reason to the fact that using urea for fertilization increases the percentage of nitrogen in the plant because urea contains a high percentage of nitrogen and decomposes quickly in the soil to release nitrogen that the plants can use as a source of nutrition, which is reflected in the percentage of protein in the plant. The plant response to water salinity differed according to the nitrogen fertilization rates. There was a significant difference in the character of the protein content in the seeds. The combination between water 120 ppm and the nitrogen fertilization rate 200 kg/ha gave the highest averages for the trait, while the combination between salinity 12000 ppm and 0 kg/ha gave the lowest averages. The results showed that the combination of 12000 ppm and a nitrogen fertilization rate of 200 kg/ha was higher than 120 ppm with a fertilization rate of 0 kg/ha (control), meaning that the plant responded significantly to nitrogen fertilization (see Fig.5).

,

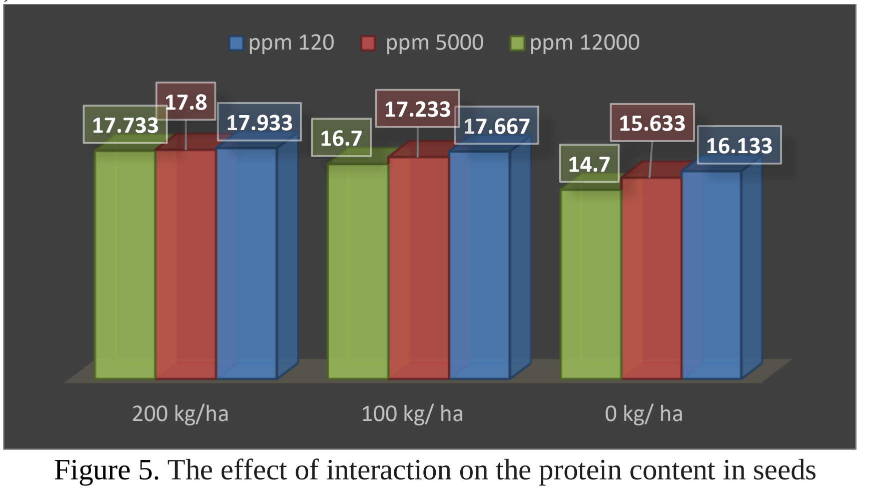

Figure 5. The effect of interaction on the protein content in seeds

http://www.doi.org/10.62341/msfr1004

These findings are compatible with (Mantovani *et al*., 2022), who indicated that nitrogen fertilization provides the nitrogen element in the soil and is available to the plant. Nitrogen is included in protein synthesis, which is important for plant growth and thus overcoming salt stress, and this is reflected in the percentage of protein in the plant.

5. Percentage of nitrogen in the plant (%)

The results of the variance analysis, as shown in Table (8), indicated that there were significant differences between the treatments and their effect on the percentage of nitrogen in the plant. The effect of salty water varied and was negative, which indicates the presence of an inverse proportion, meaning that the characteristic decreases as the percentage of salinity in the irrigation water increases. Water with 120 ppm gave the highest averages of 1.7056%, while it decreased to 1.6011% when the salinity of the irrigation water increased to 12000 ppm. This may be due to salt stress on the plant. (Wardany et al., 2022) stated that the reason for this is because salt water contains high concentrations of salt and other ions, which can affect the plant growth process and reduce the efficiency of using water and nutrients, thus affecting the percentage of nitrogen in the plant. The results in the Table (8) indicated that the higher percentage of nitrogen fertilization, the greater percentage of nitrogen in the plant. The fertilization rate of 200 kg/ha gave the highest averages for the trait, amounting to 1.7367%, while the rate of 0 kg/ha gave the lowest averages for the trait, amounting to 1.5122%. This may be attributed to the fact that using 200 kg/ha worked to provide nitrogen in the soil and gave the plant the opportunity to absorb it, increase the size and number of cells, and stimulate the plant to absorb and grow. The plant's response to water salinity according to fertilization rates varied highly significantly, as the combination between water 120 ppm and fertilization rate 200 kg/ha gave the highest averages, while the combination between salinity 12000 ppm and 0 kg/ha gave the lowest averages Fig.6. This is consistent with (Ali and Ashraf, 2013) (مبارك و الشمري، 2019), whereby increasing the fertilization rate led to a gradual increase in the production of leaves, cuttings, and stems of the plant. This was attributed to the fact that nitrogen fertilization works to reduce the salt stress of the plant by increasing plant growth, increasing its ability to tolerate salinity and thus increasing the efficiency of water absorption and nutrients. This is reflected in the trait, but the trait

http://www.doi.org/10.62341/msfr1004

decreased with age due to the process of photosynthesis and respiration that occurs in plant tissues. When the plant grows and ages, the number of cells and the area of the leaf increases, which leads to an increase in the amount of starch that is stored in the tissues, since starch represents the largest percentage. the dry mass, increasing its percentage means a lower percentage of nitrogen in the plant (Passoni *et al*., 2019) and (العيساوي، 2019).

Table 8. The effect of salt water, nitrogen fertilization rates, and their interaction on the percentage of nitrogen in plants (%)
Means with similar letters have no significant differences, Means with different letters

NFR / Water salinity	200 kg / ha	100 kg / ha	0 kg/ ha	Mean
ppm 120	1.8267a	1.7633b	1.5267e	1.7056a
ppm 5000	1.6867c	1.6100d	1.5233e	1.6067b
ppm 12000	1.6967c	1.6200d	1.4867f	1.6011b
Mean	1.7367a	1.6644b	1.5122c	1.6378
LSD 5%	salinity×nitrogen	nitrogen	Salinity	
	0.03199	0.01377	0.03085	

have significant differences

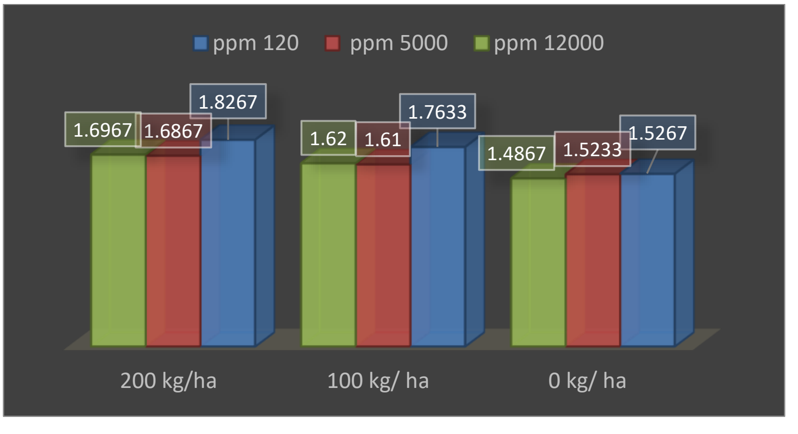

Figure 6. The effect of interaction on the percentage of nitrogen in plants

6- Percentage of phosphorus in plants (%)

The results of the analysis of variance showed that there were significant differences between the treatments in their effect on the percentage of phosphorus in the plant due to the influence of salt water, highly significant effects between the rates of nitrogen fertilization and the interaction between them. The effects of salt

http://www.doi.org/10.62341/msfr1004

water varied between them in the character of the phosphorus percentage in the plant, as shown in Table (9).

Table 9. The effect of salt water, nitrogen fertilization rates, and their interaction on the percentage of phosphorus in plants (%)

N.F.R / Water salinity	200 kg/ha	100 kg/ha	0 kg / ha	Mean
ppm 120	0.5600ab	0.5067bc	0.4400de	0.5022a
ppm 5000	0.5833a	0.5200b	0.4233e	0.5089a
ppm 12000	0.5667a	0.4800cd	0.3600f	0.4689b
Mean	0.5700a	0.5022b	0.4078c	0.4933
LSD 5%	salinity×nitrogen	nitrogen	Salinity	
	0.04553	0.01729	0.04523	

Means with similar letters have no significant differences, means with different letters have significant differences, NFR = Nitrogen Fertilization Rates

It was negative in an inverse relationship, as water at 5000 ppm gave the highest averages of 0.5089%, while salinity at 12000 ppm gave the lowest averages for the characteristic at 0.4689%. This is consistent with the results of (Wardany et al., 2022), who attributed the reason to the fact that salty water contains high concentrations of salt and other ions, which can affect the absorption process of water and nutrients in the soil and thus reduce growth efficiency. The table also shows that nitrogen fertilization rates have a positive effect with a direct relationship, that is, the higher the nitrogen fertilization rate, the greater the phosphorus percentage in the plant. The 200 kg/ha fertilization rate gave the highest averages, amounting to 0.5700%, while the 0 kg/ha rate gave the lowest averages, amounting to 0.4078%. This is in agreement with the results of (Almodovar et al., 2008), who mentioned that nitrogen fertilization made the nitrogen element available, released into the soil, and absorbed by plants. Although urea does not contain phosphorus, its use does not increase its percentage directly, but it can lead to an increase in plant growth and thus increasing their consumption of other nutrients present in the soil, and this leads to an increase in their percentage in the plant. The results showed a highly significant difference in the interaction between water salinity and nitrogen fertilization rates. The interaction between water salinity at a concentrations of 5000 ppm and12000 ppm with fertilization rate of 200 kg/ha gave the highest averages, while the combination between 12,000 ppm and 0 kg/ha gave the lowest averages Fig.7. This is consistent with (Ali and Ashraf, 2013),

http://www.doi.org/10.62341/msfr1004

whereby increasing the fertilization rate led to a gradual increase in the production of leaves, shoots, and stems of the plant. This was attributed to the fact that nitrogen fertilization works to reduce the salt stress of the plant by increasing the plant's growth and increasing its ability to tolerate salinity and the increase in efficient absorption of nutrients from the soil, although fertilization does not have a direct effect on the percentage of phosphorus in the plant, it improves its ability to make maximum use of the available nutrients.

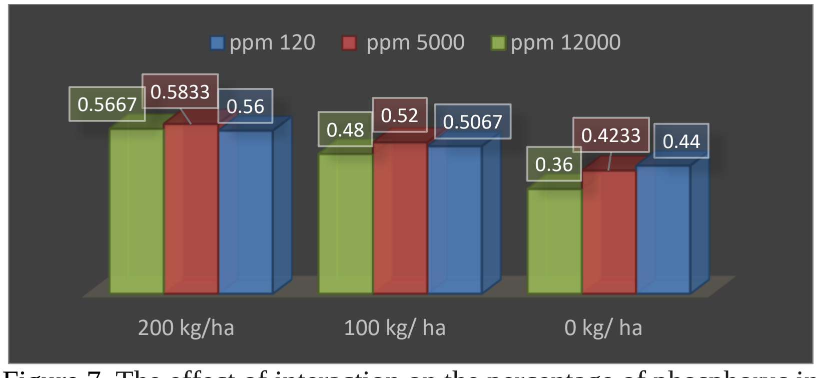

Figure 7. The effect of interaction on the percentage of phosphorus in plants (%)

7- The percentage of potassium in the plant (%)

The results of the variance analysis, as shown in Table (10), indicated that there were statistically significant differences between the treatments for the percentage of potassium in plants due to the influence of salt water, the effects of nitrogen fertilization rates, and the interaction between them. The effect of salt water treatments varied among them on the percentage of potassium in the plant, indicating the existence of an inverse relationship, as water of 5000 ppm and 120ppm gave the highest averages of 0.1944% 0.1889% respectively, while salinity of 12000 ppm gave the lowest averages of 0.1578%. Table (10) shows that nitrogen fertilization rates have a positive effect with a direct relationship, as a fertilization rate of 200 kg/ha gave the highest averages for the trait, amounting to 0.2167%, while rate of 0 kg/ha gave the lowest averages for the trait, amounting to 0.1444%. This is consistent with the results of (Almodovar et al., 2008), urea does not contain potassium, and its use does not increase its percentage directly, but it can increases the growth of plants and thus increase their consumption of other nutrients present in the soil, this leads to an increase in their percentage in the plant, The plant's response to

http://www.doi.org/10.62341/msfr1004

water salinity varied according to the nitrogen fertilization rates in the potassium ratio. The combination between water 120 ppm and the fertilization rate 200 kg/ha gave the highest averages, while the combination between salinity 12,000 ppm and 0 kg/ha gave the lowest averages Figure 8. This is consistent with (Ali and Ashraf, 2013), who indicated that increasing the fertilization rate led to a gradual increase in the production of leaves, shoots, stems, and roots of the plant in general. This was attributed to the fact that nitrogen fertilization works to reduce the salt stress of the plant by increasing the plant's growth and increasing its ability to tolerate salinity and optimize the exploitation of nutrients in the soil.

Table 10. The effect of salt water, nitrogen fertilization rates and their interaction on the potassium percentage (%)

N.F.R / Water salinity	200 kg / ha	100 kg / ha	0 kg / ha	Mean
ppm 120	0.2200a	0.1933cd	0.1533e	0.1889a
ppm 5000	0.2167b	0.1933cd	0.1733de	0.1944a
ppm 12000	0.2133c	0.1533e	0.1067f	0.1578b
Mean	0.2167a	0.1800b	0.1444c	0.1804
LSD 5%	salinity × nitrogen	nitrogen	Salinity	
	0.03120	0.02054	0.01708	

Means with similar letters have no significant differences, means with different letters have significant differences, NFR = Nitrogen Fertilization Rates

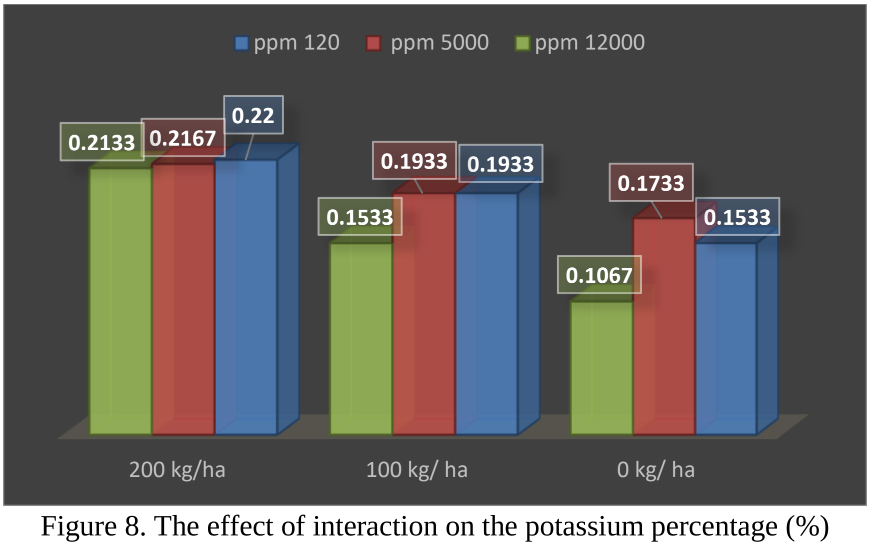

Figure 8. The effect of interaction on the potassium percentage (%)

http://www.doi.org/10.62341/msfr1004

Conclusions:

The study showed a decrease in the productivity and quality of Panicum maximum, Mombasa cultivar, with increasing salinity concentrations in irrigation water from 120 to 12,000 (ppm). It was found that plant resistance to irrigation water salinity improves with nitrogen fertilization in a direct relationship, as fertilization at a rate of 200 kg/ha, followed by fertilization at a rate of 100 kg/ha, while units with a fertilization rate of 0 kg/ha recorded the lowest averages for all studied traits, indicating the plant's response to fertilization even at high salinity concentrations. It was found that plant resistance to irrigation water salinity improves with nitrogen fertilization in a direct relationship, indicating the plant's response to fertilization even at high salinity concentrations.

Recommendations:

1. Growing the Panicum maximum cv. Mombasa crop in poor and marginal lands because of its ability to withstand harsh environmental conditions such as water and soil salinity, wind fluctuations, and temperatures.
2. Although the plant tolerates high levels of irrigation water salinity, irrigation water salinity levels must be reduced as much as possible to improve the economic viability and nutritional value of the crop.
3. We recommend fertilizing the plant at a rate of 200 kg/ha of nitrogen, as this level is considered ideal for plant growth, improves its nutritional properties, and increases its resistance to the effects of irrigation water salinity.
4. We recommend introducing the Panicum maximum cv. Mombasa crop into other experiments with higher nitrogen levels or comparing nitrogen fertilization (urea) with organic fertilizer.

References

رضوان، محمد. السيد. الفخري، عبد الله. قاسم. (1976). محاصيل العلف والمراعي الجزء الثاني. مؤسسة دار الكتب للطباعة والنشر جامعة الموصل. العراق.

الصحاف، فاضل حسين (1989). انظمة الزراعة بدون استخدام التربة. مطبعة بيت الحكمة، جامعة بغداد، وزارة التعليم العالي والبحث العلمي، العراق. ص 21.

http://www.doi.org/10.62341/msfr1004

العيساوي، حسين كزار شلال. (2019). تقييم اداء تركيبين وراثيين من محصول البونيكام (Panicum maximum) تحت مواعيد وطرائق زراعة مختلفة في العراق. رسالة ماجستير ، جامعة بغداد. العراق.

غيث ادريس راقي العبيدي. (2019). النمو الحضري وأثره على الاستهلاك المياه بمدينة طبرق. رسالة ماجستير غير منشورة. جامعة بنغازي، ليبيا.

فرج، حمزة طالب. جدوع، خضير عباس. (2015). تأثير مستويات النتروجين وتجزئة إضافته في حاصل حبوب الشعير. مجلة العلوم الزراعية العراقية، 6 (46) ، 942- 934.

فوزي محمد الدومي (2000). أساسيات وتطبيقات علم التربة، جامعة عمر المختار. البيضاء.

مبارك، نادر. فليح. علي. الشمري، غالب. ناصر. (2019). تأثير اعمار الشتلات في بعض الصفات المظهرية والنوعية وحاصل المحصول العلفي بونيكام Panicum maximum cv. Mombasa. المؤتمر الدولي العلمي الثالث للعلوم الزراعية، كلية الزراعة، جامعة ديالي، العراق.

A.O.A.C. (1980). Official Methods of Analysis. 13th Ed. Association of Official Analytical Chemists. Washington, D.C. USA .

Abughlelesha, S. M., & Lateh, H. B. (2013). A Review and Analysis of the Impact of Population Growth on Water Resources in Libya. World Applied Sciences Journal, 23 (7), 965-971 .

Ali, A. Y. A., Ibrahim, M. E. H., Zhou, G., Nimir, N. E. A., Elsiddig, A. M. I., & Jiao, X. (2021). Gibberellic acid and nitrogen efficiently protect early seedlings growth stage from salt stress damage in sorghum. Scientific Reports, 11, 1-11 .

Ali, M., & Ashraf, M. (2013). Salinity-induced changes in gene expression and ion homeostasis in pomegranate (Punica granatum) leaves. Journal of Plant Physiology, 170(13), 1219-1228 .

Almodovar, L. E., Valencia, E., & Rodriguez, y. A. (2008). Liquid Urea Rate Effects on Nutritive Value of 8-Week Regrowth of Guineagrass {Panicum maximum Jacq.) Hay. AgEcon Search, 501-504 .

Benabderrahim, M. A., & Elfalleh, W. (2021). Forage Potential of Non-Native Guinea Grass in North African Agroecosystems: Genetic, Agronomic, and Adaptive Traits. Agronomy .

Bonfim-Silva, E. M., Oliveira, N. P., Mazero, H. M., & Alves, D. J. (2022). Production and morphophysiological responses of Panicum maximum

http://www.doi.org/10.62341/msfr1004

cv. BRS Zuri to water availability. Australian Journal of Crop Science, 16(11), 1203-1211 .

Braz, g. d. s. t., Janaina, A. M., Liana, J. D., Miranda, D. F., & Evaristo, M. D. (2017). Genotypic value in hybrid progenies of (Panicum maximum) Jacq.J. Bras. Zootec, (9)47, 1-6 .

CORSI, M., & SANTOS, P. M. (1995). Potencial de produção do Panicum maximum .

Elsiddig, A. M. I., Zhou, G., Nimir, N. E. A., & Ali, A. Y. A. (2022). Effect of exogenous ascorbic acid on two sorghum varieties under different types of salt stress. Journal of Agricultural Research, 82, 10-20 .

FAO. (2017). Voluntary Guidelines for Sustainable Soil Management. Food and Agriculture Organization of the United Nations Rome, Italy Rengasamy P (2006) World salinization with emphasis on .

Hamdy, A. (1998). Salin irrigation management for sustainable use ciheam/mai-Bari. Head, G.C, 41, 197-206 .

Hare, M. D., Phengphet, S., Songsiri, T., Sutin, N., & Stern, E. (2013). Effect of cutting interval on yield and quality of two Panicum maximum cultivars in Thailand. Tropical Grasslands – Forrajes Tropicales, 1, 87−89 .

Haynes, R. J. (1980). A comparison two modified Kjedhal digestion techniques for multielement plant analysis with convention wet and dry ashing methods. Comm in Soil Sci. Plant Analysis, 11, 459-467 .

Hussein, H. (2001). Development of environmental GIS database and its application to desertification study in Middle East. Japan, Chiba University, Graduate School of Science and Technology. (PhD thesis) .

Mantovani, J. R., Bernardes, J. d. S., Costa, B. d. S., & Esteves, G. d. F. (2022). Production and nutritional value of Mombaça grass with application of whey as an alternative nitrogen source. Research, Society and Development, 11 .

Miles, D. (1987). Salinity in Arkansas valley of olorado. Environmental protection agency, Intern agency agreement report epa-aig-d4-oss 4, C.O.

Peixoto, M. A., Coelho, L. F., FBraga, M. C., & SSilva, C. A. (2010). Yield quality and nutrient uptake of Panicum maximum as affected by nitrogen and phosphorus fertilization. Journal of Agronomy and Crop Science, 196(4), 237-249 .

Rhoades, J. D., & Dinar, A. (1991). Reuse of agricultural drainage water to maximize the beneficial use of multiple water supplies for irrigation. The Economics and Management of water and Drainage in Agriculture, 99 – 115

http://www.doi.org/10.62341/msfr1004

Rodrigues, M. O. D., Santos, A. C. d., Rodrigues, M. O. D., Sousa, O. S. J. F., & Faria, F. G. d. (2017). Nitrogen during the establishment period of Mombasa grass Nitrogênio em períodos do estabelecimento de capim Mombaça. Ciências Agrárias, 38, 513-520 .

Steel, R. G., & Torri, T. M. (1980). Principles and Procedures of Statistics. Mc Graw-Hill Book Co. Inc. New York. USA. 485 .

Thongruang, S., Manatrinon, S., Swangkit, T., & Kochasopon1, S. (2020). Yields Forage Characteristics and Nutritive Values of Purple Guinea Grass and Mombasa Guinea Grass at Different Cutting Ages. JOURNAL OF MAHANAKORN VETERINARY MEDICINE, 15(2), 199-207 .

Wardany, A. S. E., El-Bordeny, N., Abdrabou, R. T., Bakr, A. A., & Abd-Elkrem, Y. M. (2022). Effect of Different Levels of Salinity and Anti-Transpiration on the Growth Characteristics and Chemical Composition of Panicum maximum (Jacq.). Journal of Agricultural Sciences, 30(1), 87-96 .

Zaman, M., Shahid, S. A., & Heng, L. (2018). Guideline for Salinity Assessment, Mitigation and Adaptation Using Nuclear and Related Techniques.