Journal of Plant Production

Journal homepage: www.jpp.mans.edu.eg
Available online at: www.jpp.journals.ekb.eg

Performance of Two Fodder Pearl Millet Varieties under Different Seeding and Nitrogen Fertilizer Rates

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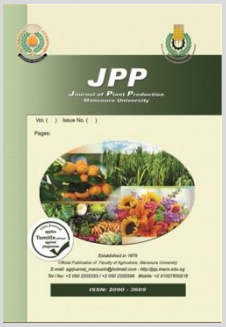

ABSTARCT

Two field experiments were carried out at Sids Agric. Research Station, BeniSuef, Governorate, ARC, Egypt during the two successive summer seasons of the years 2016 and 2017 to study the effect of seeding rate (15, 20 and 25 kg/fed) and N-rates of nitrogen (60, 90 and 120 kg N/fed) on two variety of forage pearl millet (Shandweel 1 as a local variety and Saudian variety).). Saudian variety (*Pennsitium glaucum (L) R. Br. : Syn. Pennsitium americanium* (L) Fam. Poaceae. This introduced variety was identified by the Flora and Phytotaxonomy Research Department, Agricultural Museum, Dokki, Giza, Egypt. The experiments were laid out in split plot design with three replications. Seeding rate at 25 kg/fed recorded the highest plant height with using the 3rd N levels for the two varieties. More, the local variety surpassed Sau8dian variety. Saudian variety achieved the highest means of leaf stem ratio at 20 kg seeding rate/fed when plots treated with 120 kg N/fed. While, the highest mean of stem diameter recorded from Shandaweel 1 at the rate of 20 kg/fed and using 120 kg N/fed. In addition the rate of 20 kg/fed and 90 or 120 kg N/fed recorded the highest mean of fresh and dry yields or the two varieties. Finally, protein% recorded from Saudian variety at the rate of 20 kg/fed and 90 kg N/fed while, local variety recorded the highest mean for CF% and ash content at the same rate of seeding rate and nitrogen levels.

Keywords: Millet varieties, Seeding rates, Nitrogen fertilizer levels,, forage yield and quality.

INTRODUCTION

In Egypt, there is a gap between production and consumption of fodder in summer season, increasing the productivity of some promising annual forage types is getting interest. Growth and yield of pearl millet can be enriched only through efficient agronomy (i.e. seeding rate, nitrogen fertilizer and new varieties) and breeding methods.

Millet is a group of small-grained cereal grown around the world for food and fodder. Pearl millet (*Pennisetum glaucum* L.) is an important and widely cultivated staple crop in many countries. The crop is well knowable by forage producers especially in arid and semi-arid areas for its heat, vigorous growth, quick re-growth after cutting, and free from hydrocynide acid (Bramhaiah *et al*., 2018 and Ziki *et al*., 2019).

Seedling density is an important agronomic factor which greatly influences the micro climate of the field and eventually yields of agricultural crops. It can influence growth, yield and quality parameters (Ahmad, 2003). Carberry and Campbell (1985) concluded that dry matter accumulation in main axis was unaffected by increased population. Increased population reduced the weight per plant, leaf area and tiller number per plant at 50% anthesis. Similarly, Ayub *et al.* (2002) also reported that increase in seed rate significantly increased the plant density, plant height and yield but significantly decreased the stem diameter, leaf area, crude fibre, crude protein and ash percentage. Information on the interactive effect of nitrogen application and seeding rates on fodder yield and quality of pearl millet is lacking in Pakistan. The present studies were therefore, designed to evaluate the effect of seed rate and nitrogen levels on fodder yield and quality of pearl millet.

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is drought tolerant and early maturing. Productivity may be greatly influenced using appropriate nitrogen (N) inputs for maximum profitability (Ajeigbe *et al.* 2019). Poor soil fertility is the most important constraints to crop production in arid and semi arid region.

Combined analysis of data over the two seasons revealed that growth parameters of millet forage yield and quality traits were significantly affected by the full recommended nitrogen rate 120 kg N fed^{-1} , Hoda Ibrahim *et al.* (2013) . Soil fertility management i.e nutrient management particularly nitrogen plays a major role in increasing production and productivity of pearl millet. Nitrogen (N) is an essential nutrient and key limiting factor in crop production of different agro-ecosystems. Nitrogen is the major nutrient required by pearl millet under agri-horti system which positively increases the growth attributes, length and width of panicle, test weight, number of grain panicle-1, grain weight panicle-1 and finally improve the yield (Prasad *et al*., 2014).

Variety plays an important role in forage production. Longer duration varieties are most suitable for forage production because the long period of growth before seeds set allows them to produce more dry matter than the shorter duration varieties. The Malgorou variety produced more dry matter than the other varieties. The reasons for the significantly higher dry matter production of Malgorou were a longer period before reaching boot stage, allowing more leaf and stem production and production of a higher number

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DOI: 10.21608/jpp.2021.205709

of tillers. Malgorou also had the highest dry matter content at grain harvest, making it a candidate for a dual purpose (grain/forage) variety (Pasternak *et al.*, 2012).

The present investigation aimed to study the performance of Shandwell and Saudian millet under seeding rates and two fertilizer levels in Beni Suef District.

MATERIALS AND METHODS

Two field experiments were carried out at Sids Agric. Research Station, Beni Suef, Governorate, ARC, Egypt during the two successive summer seasons of 2016 and 2017. These experiments were conducted to study the influences of seeding rate (15, 20 and 25 kg/fed), nitrogen fertilizer levels (60, 90 and 120 kg N fed^{-1}) for two variety of pearl millet (Local millet (cv. Shandaweel-1) and Saudian millet) on growth, forage yield and quality traits of forage millet. Local variety Shandwell 1 and introduced variety from Saudia Arabian (Saudian variety characterized by its abundance of branching and leaves). Saudian variety (*Pennsitium glaucum (L) R. Br. : Syn. Pennsitium americanium* (L) Fam. Poaceae. This introduced variety was identified by the Flora and Phytotaxonomy Research Department, Agricultural Museum, Dokki, Giza, Egypt.

The texture of the soil of the experimental site was clay and their physical and chemical analyses shown in Table1 were determined according to Page *et al*. (1982). The preceding crop in the two seasons was Egyptian clover and sowing date was 16 May and 20 May in the first and second seasons respectively. The experiments were laid out in split plot design with three replications. Seeding rate devoted in the main plot and nitrogen fertilizer rates located in the sub-plot for the two varieties. Each plot size was 6 m^2 (2x3m). The seeds were hand-drilled in rows 20 cm apart at the seeding rate of 20 kg fed^{-1}. Nitrogen fertilizer was applied in the form of ammonium nitrate (33.5% N) at the different rates under study was divided into three equal doses. The first dose was added after 21 days from sowing, the second and the third doses were added after the first and the second cuts, respectively. Each of calcium superphosphate (15.5% P_2O_5) at the rate of 150 kg fed^{-1} and potassium sulphate (48% K_2O) at the rate of 50 kg fed^{-1} was applied before ploughing. The other cultural practices were carried out as recommended .Three cuts were taken during each growing season after 55, 90 and 125days of planting.

Table 1. Physical and chemical soil properties of the experimental site at the depth of (0-15 cm) in the summer seasons of the year 2016 and 2017

Soil property	2016	2017
Mechanical analysis:		
Sand%	21.13	21.18
Silt %	34.70	34.80
Clay%	44.60	44.35
Soil texture%	Clay	Clay
Chemical analysis:		
pH	8.44	8.40
EC dsm^{-1}	1.03	1.02
Total soluble N (mg/kg^{-1})	44.12	44.20
Available K (mg/kg^{-1})	179.5	173.16
Available P (mg/kg^{-1})	4.89	4.65
Organic matter (%)	0.75	0.73

Data were recorded at each harvest on five guarded plants plot-1 to determine: 1. Plant height (cm); length of the main stem from soil surface to stem-tip. . 2. Stem diameter (cm) at third internode above soil surface. 3. Leaf stem ratio 4.Fresh forage yield (Kg/plot): plants were hand clipped and weighed in kg $plot^{-1}$. 5. Dry forage yield (kg $plot^{-1}$): 100g plant samples from each plot were dried at 105ºC till constant weight and dry matter percentage (DM %) was estimated and turn to dry forage yield (kg/plot) by multiplying fresh forage yield (kg $plot^{-1}$) X dry matter percentage. 6. Leaf stem ratio was determined by divided weight of leaf on weight of stem. 7. Chemical analysis followed the conventional method recommended by the Association of Official Agricultural Chemists A.O.A.C (1984) on the dried samples at 70 ºC for each cut to determine crude protein (CP %), crude fiber (CF %) and ash% were done for 2017 season only.

Statistical analysis: Data were statistically analyzed according to procedures outlined by Snedecor and Cochran (1980) using MSTAT computer program V.4. (1986) Bartlett's test was done to test the homogeneity of error variances. The test was significant for all traits, thus data were not combined in both seasons.

RESULTS AND DISCUSSION

Plant height (cm):

Results in Table 2 elucidated the effect of the seeding rate, applied nitrogen levels on Plant height (cm) of two forage millet varieties. Data show that the differences among seeding rates on plant height were significant in all cuts in the first and second seasons. Data of plant height recorded that the highest mean all over the cuts with 25 kg seeding rates/fed. The highest plant height was recorded in the first season for Shandaweel variety in cut2 while in the variety of saudian variety in the third cut in the first season. While, Shandaweel variety surpassed Saudian variety in the second season. Plant density was significantly increased with increase in seed rate. It is quite obvious to obtain higher plant height at higher seed rate provided that seeds have similar viability and 1000-seed weight (Ayub *et al*., 2007).

Regarding to the effect of nitrogen fertilizer rates on plant height, there was a significant difference in the three cuts in the two seasons of 2016 and 2017 for the two varieties. Increase in plant height with nitrogen application has also been reported by Khateek *et al*. (1999) and these might be due to was clear from these results that, with the increase in N application, the plant photosynthesizing area, and the assimilate production were increased, therefore caused more plant height, more number of shoots per plant, greater leaf area/plant and thus increased fresh forage weight per plant (Bramhaiah *et al*., 2018 and Joshi *et al*., 2018). Similar significant N effect on vegetative growth characters development in pearl millet were reported by several authors (Bhuva *et al*., 2018 and Thakor *et al*., 2018). The highest plant height recorded from Shandweel 1 which recorded 165.56 and 161.33 cm in the two seasons in the second cut while, the lowest mean of plant height recorded from Saudian variety which achieved 72.88 and 95.0 cm in the two seasons in the first cut. These findings refers to plant height is controlled by the genetic makeup of the species and the environment to which the plants are subjected during the growth and development (Ayub *et al*., 2002). Moreover, These results may be due to the effect of nitrogen fertilization in pushing growth of pearl millet and the increments in inter-node length or/and number of

internodes, number of tillers plant-1 . These findings are in harmony with those obtained by Ayub *et al*. (2009)

The interactions between seeding rate and nitrogen fertilizer were significant for two varieties except fits cut in 2nd cut for Shandaweel 1 and Saudian variety in the first season and 1st and 2nd cut in the two seasons for two varieties.

Table 2. Effect of seeding rates (kg/fed), nitrogen fertilizer levels (kg/fed) and its interactions on plant height (cm) of two pearl millet varieties in 2016 and 2017 growing seasons.

Treatment	Plant height (cm)											
	Shandweel 1 variety			Saudian variety			Shandweel 1 variety			Saudian variety		
	2016						2017					
	Cut1	Cut2	Cut3	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3
Seeding rates (A):												
15 kg/fed (A1)	108.44	133.44	126.67	76.78	99.33	99.57	11978	135.89	124.14	93.22	95.22	105.33
20 kg/fed (A2)	118.00	153.11	132.88	82.88	106.77	118.78	130.33	146.88	136.22	104.33	107.11	116.11
25 kg/fed (A3)	120.11	168.00	140.22	91.67	114.33	126.00	140.78	158.44	142.33	115.22	116.89	124.33
F-test	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	1.56	10.43	5.61	6.36	5.99	8.24	7.45	8.25	6.39	8.16	12.11	5.34
N:fertilizer levels (B):												
60 kg/fed (B1)	106.78	134.89	120.67	72.88	92.22	99.89	119.89	126.78	122.36	95.00	97.88	89.44
90 kg/fed (B2)	113.33	154.11	136.89	85.11	111.89	119.56	132.22	153.11	136.56	105.55	105.33	123.22
120 kg/fed (B3)	126.44	165.56	142.21	95.33	116.33	124.89	138.78	161.33	142.78	112.22	116.00	133.11
F-test	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	1.15	9.18	5.52	6.33	5.79	8.22	7.46	8.27	6.36	8.18	11.89	3.38
Interactions (AXB)												
A1B1	NS	121.33	108.00	64.00	NS	t90.67	NS	NS	113.09	NS	NS	80.67
A1B2	NS	135.67	133.33	77.67	NS	103.00	NS	NS	129.66	NS	NS	112.33
A1B3	NS	143.33	138.67	88.66	NS	105.00	NS	NS	129.67	NS	NS	123.00
A2B1	NS	136.33	124.33	72.66	NS	97.67	NS	NS	124.00	NS	NS	86.67
A2B2	NS	1357.67	135.67	84.33	NS	125.67	NS	NS	141.00	NS	NS	126.66
A2B3	NS	165.33	138.67	91.67	NS	133.00	NS	NS	143.67	NS	NS	135.00
A3B1	NS	147.00	129.66	82.00	NS	111.33	NS	NS	130.00	NS	NS	101.66
A3B2	NS	169.00	141.66	93.33	NS	130.00	NS	NS	142.00	NS	NS	130.67
A3B3	NS	188.00	149.33	99.66	NS	136.67	NS	NS	150.00	NS	NS	141.33
LSD 0.05	-	18.07	9.72	9.03	-	11.22	-	-	9.04	-	-	9.25

Leaf/stem ratio (L/S):

Results in Table (3) revealed that leaf stem ratio was significantly affected by seeding rates in all cuts in the first and second seasons for two varieties under the study. The highest means of L/S ratio were 0.532, 0.759, 0.498 and 2.762, 3.28, 1.674 for the Shandaweel 1 and Saudian varieties in the three cuts for the plots received 20 kg/fed. While, the lowest means recorded from 15 kg/fed for all cuts. In addition, in the second seasons, the plots which received 25 kg/fed recorded the highest mean in all cuts except the 2nd cuts for variety Shandaweel 1 and 3rd for Saudian variety recorded the highest mean from 20 kg/fed. The decrease in leaf/stem with increased seeding rates might have been due to more competition between plants for light, nutrients and water. The results are in agreement with the findings of Carberry and Campbell (1985).They reported that increased population decreased leaf area tiller^{-1} by 66%.

Nitrogen fertilizer affected significantly all cutting of the two varieties of pearl millet in the first season and second seasons. Leaf stem/ratio recorded the highest mean when treated plots with 120 kg N/fed for Shandaweel 1 and Saudian variety in all cuts in the first and second seasons, respectively and the lowest one recorded from 60 kg N/fed. (Table 3). The significant effect of nitrogen application on leaves/stem has reported by Safdar (1997). Data of both seasons show that highest mean of leaf/stem/ratio recorded from Saudian variety. These results refere to Pasternak *et al*. (2012) they concluded that Dwarf varieties of pearl millet should make better quality forage than tall varieties because the dwarf varieties have a higher leaf/stem ratio.

The interactions between seeding rates and nitrogen fertilizer levels were significant in all cuts in the two seasons for two varieties except 3rd cut in the first season for Saudian variety and 2nd and 3rd cuts in the second season for Shandaweel variety. The highest mean recorded from 25 kg/fed. for the plots treated with 90 kg N/fed for Shandaweel variety in the 1st season in all cuts and first and second cuts of Saudian variety. While, in the second seasons, the treatment of interaction between 20 kg/fed seeding rates and 120 kg N/fed for two variety recorded the highest means.

Stem diameter (cm)

Data illustrated in Table (3a) revealed that seeding rates affected significantly stem diameter (cm) in all cuts in both seasons for two varieties. The thickest stem plant for two varieties recorded from 20 kg/fed in various cuttings of pearl millet. The highest mean of for Shandaweel was (1.357, 0.678, 1.840 and 1.454, 1.012 and 0.943 cm) while, the thickest stem diameter of Saudian variety recorded the second rank of seeding rate (0.778, 0.630, 0.563 and 0.788, 0.854 and 0.641 cm) of three cuts in the first and second seasons, respectively while, the average thinnest plant mean over both seasons for two varieties recorded from seeding at rate of 25 kg/fed. The stem diameter was decreased with increased seed rate and decrease was significant at each increased seed rate. These results confirm the findings of Ayub *et al*. (2003).

Data in Table (3a) showed significant differences N-fertilizer levels in both seasons for two varieties in all cuts. The thickest stem when plots received 120 kg N/fed in the first and second seasons, respectively for two varieties. While, the stem diameter mean recorded the lowest for plots received 60 kg N/fed. These results are inagreement Cho *et al.* (2001) they reported that diameter was recorded at nitrogen level of 150 kg/ha and control, respectively. Cho *et al*. (2001) have also reported significant effect of nitrogen application on stem diameter of pearl millet. Local pearl

millet variety Shandaweel 1 surpassed Saudian variety in the two seasons on all cuts. Plant diameter is controlled by the genetic makeup of the species and the environment to which the plants are subjected during the growth and development (Ayub *et al*., 2002).

Revealed data in the same table showed the interaction between all studied factors on stem diameter millet plant. There were insignificant differences between seeding rate and nitrogen fertilizer rate in cut2 in the first season and cut 3 in the second season for Shandaweel 1 in addition cut1 in the two seasons of Saudian variety didn't reach the probability of significance.

Table 3. Effect of seeding rates (kg/fed), nitrogen fertilizer levels (kg/fed) and its interactions on leaf/stem ration (L/S) of two pearl millet varieties in 2016 and 2017 growing seasons.

Treatment	Leaf /stem ratio											
	Shandaweel 1 variety			Saudian variety			Shandaweel 1 variety			Saudian variety		
	2016						2017					
	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3
Seeding rates (A):												
15 kg/fed (A1)	0.429	0.660	0.342	1.490	3.267	1.170	0.606	0.889	0.479	0.923	2.551	0.944
20 kg/fed (A2)	0.532	0.759	0.498	2.762	3.283	1.674	0.693	1.050	0.538	1.141	2.754	1.044
25 kg/fed (A3)	0.452	0.721	0.282	2.488	2.666	1.377	0.831	1..131	0.680	1.437	2.277	0.932
F-test	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	0.116	0.066	0.087	0.720	0.390	0.188	0.101	0.107	0.089	0.111	0.239	0.122
N:fertilizer levels (B):												
60 kg/fed (B1)	0.359	0.653	0.323	1.889	2.556	1.140	0.541	0.909	0.450	0.854	1.939	0.887
90 kg/fed (B2)	0.491	0.724	0.367	2.279	3.114	1.360	0.732	1.057	0.594	1.212	2.567	0.976
120 kg/fed (B3)	0.563	0.762	0.432	2.572	3.546	1.721	0.857	1.104	0.652	1.434	3.077	1.059
F-test	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	0.107	0.065	0.088	0.718	0.391	0.189	0.103	0.106	0.089	0.114	0.240	0.123
Interactions (AXB)												
A1B1	0.317	0.563	0.274	0.967	2.533	NS	0.417	NS	NS	0.810	1.977	0.827
A1B2	0.393	0.707	0.310	1.517	3.433	NS	0.653	NS	NS	0.940	2.690	0.977
A1B3	0.577	0.710	0.470	1.987	3.833	NS	0.747	NS	NS	1.020	2.987	1.030
A2B1	0.407	0.717	0.453	2.476	2.767	NS	0.480	NS	NS	0.847	2.107	0.897
A2B2	0.567	0.747	0.517	2.887	3.250	NS	0.727	NS	NS	1.147	2.873	1.067
A2B3	0.623	0.813	0.523	2.993	3.833	NS	0.873	NS	NS	1.430	3.283	1.170
A3B1	0.353	0.680	0.270	2.233	2.367	NS	0.727	NS	NS	0.907	1.733	0.937
A3B2	0.513	0.720	0.273	2.433	2.660	NS	0.817	NS	NS	1.550	2.173	0.883
A3B3	0.490	0.763	0.303	2.797	2.970	NS	0.950	NS	NS	1.853	2.960	0.977
LSD 0.05	0.184	0.106	0.151	0.880	0.734	-	0.176	-	-	0.193	0.320	0.211

Table 3a. Effect of seeding rates (kg/fed), nitrogen fertilizer levels (kg/fed) and its interactions on stem diameter (cm) of two pearl millet varieties in 2016 and 2017 growing seasons.

Treatment	Stem diameter (cm)											
	Shandweel 1 variety			Saudian variety			Shandweel 1 variety			Saudian variety		
	2016						2017					
	Cut1	Cut2	Cut3	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3	Cut1	Cu2	Cut3
Seeding rates (A):												
15 kg/fed (A1)	1.148	0.623	1.115	0.690	0.531	0.403	0.989	0.960	0.898	0.671	0.536	0.436
20 kg/fed (A2)	1.357	0.678	1.840	0.778	0.630	0.563	1.454	1.012	0.943	0.788	0.854	0.641
25 kg/fed (A3)	0.970	0.531	1.430	0.542	0.417	0.393	1.252	0.943	0.902	0.722	0.739	0.492
F-test	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	0.162	0.083	0.161	0.085	0.057	0.061	0.071	0.038	0.039	0.077	0.0072	0.050
N:fertilizer levels (B):												
60 kg/fed (B1)	0.909	0.509	0.904	0.546	0.439	0.358	1.063	0.921	0.842	0.577	0.610	0.418
90 kg/fed (B2)	1.159	0.630	1.103	0.717	0.523	0.473	1.228	0.968	0.923	0.741	0.710	0.512
120 kg/fed (B3)	1.407	0.694	1.352	0.748	0.616	0.529	1.404	1.027	0.978	0.863	0.809	0.639
F-test	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	0.164	0.085	0.162	0.087	0.058	0.064	0.071	0.036	0.037	0.076	0.092	0.052
Interactions (AXB)												
A1B1	0.920	NS	0.970	NS	0.467	0.277	0.873	0.883	NS	NS	0.407	0.363
A1B2	1.200	NS	1.074	NS	0.520	0.420	0.977	0.973	NS	NS	0.537	0.430
A1B3	1.323	NS	1.301	NS	0.607	0.513	1.117	1.023	NS	NS	0.663	0.513
A2B1	0.970	NS	1.041	NS	0.557	0.520	0.990	0.983	NS	NS	0.780	0.497
A2B2	1.347	NS	1.351	NS	0.633	0.573	1.247	1.003	NS	NS	0.850	0.653
A2B3	1.753	NS	1.817	NS	0.700	0.597	1.577	1.050	NS	NS	0.933	0.773
A3B1	0.837	NS	0.700	NS	0.293	0.277	1.327	0.897	NS	NS	0.643	0.393
A3B2	0.930	NS	0.883	NS	0.417	0.427	1.460	0.927	NS	NS	0.743	0.453
A3B3	1.143	NS	0.937	NS	0.540	0.477	1.520	1.007	NS	NS	0.830	0.630
LSD 0.05	0.277	-	0.279	-	0.101	0.106	0.123	0.062	-	-	0.114	0.086

Fresh yield (kg/plot)

Results in Table (4) revealed that seeding rates significantly affected forage fresh yield in all cuts in the first season and second seasons for the two varieties. This was true also for accumulated cuts. The highest accumulate fresh yield recorded (113.48 , 104.54 and 107.60, 99.40 kg/plot for Shandaweel 1 and Saudian varieties in the first and second seasons, respectively) recorded from the second seeding rate 20kg/fed. Meanwhile, the heaviest fresh yield for cuts recorded from the second cut for two varieties in the two seasons achieved from 20kg/fed. These findings are inaccordance with Pasternak *et al*. (2012) who reported that Fodder yield was increased with increase in seed rate. The increase in yield was mainly due to greater plant density.

Data in Table (4) show that nitrogen significantly affected fresh yield for two varieties in the two seasons for all cuts. The third dose of nitrogen recorded the highest accumulate fresh yield of pearl millet for Shandaweel 1 while, there is no significant difference between 90 and 120 kg N/fed for Saudian varieties in the first season. In addition, in the second season there is no significant difference between 90 or 120 kg N/fed. It was clear from these results that, with the increase in N application, the plant photosynthesizing area, and the assimilate production were increased, therefore caused more plant height, more number of shoots per plant, greater leaf area/plant and thus increased fresh forage weight per plant (Bramhaiah *et al*., 2018; Joshi *et al*., 2018 and Zik *et al*., 2019).

Table 4. Effect of seeding rates (kg/fed), nitrogen fertilizer levels (kg/fed) and its interactions on fresh yield (kg/plot) of two pearl millet varieties in 2016 and 2017 growing seasons.

Treatment	Fresh yield (kg/plot)															
	Shandaweel 1 variety				Saudian variety				Shandaweel 1 variety				Saudian variety			
	2016								2017							
	Cut1	Cu2	Cut3	Accu. Yield	Cut1	Cu2	Cut3	Accu. yield	Cut1	Cu2	Cut3	Accu. yield	Cut1	Cu2	Cut3	Accu. Yield
15 kg/fed (A1)	31.03	38.51	28.39	97.93	28.65	30.52	26.00	85.17	29.59	37.50	19.23	86.32	26.83	34.98	18.45	80.27
20 kg/fed (A2)	36.30	43.76	33.42	113.48	37.71	38.89	31.00	107.60	35.44	44.39	24.71	104.54	32.06	39.94	27.40	99.40
25 kg/fed (A3)	27.11	30.66	24.21	81.98	24.69	26.88	23.00	74.57	25.101	36.28	19.12	80.50	26.50	31.74	18.21	76.45
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	3.62	2.36	2.97	4.27	3.61	3.07	3.41	7.43	3.54	3.09	2.21	6.10	3.7	2.87	3.2	6.01
N:fertilizer levels (B):																
60 kg/fed (B1)	28.48	33.811	25.11	87.40	25.34	28.11	23.00	76.45	25.78	34.56	18.22	78.56	24.11	32.00	18.22	74.33
90 kg/fed (B2)	32.19	38.067	29.58	99.84	31.18	33.300	28.00	92.48	31.44	41.56	22.44	95.44	30.44	36.89	22.44	89.77
120 kg/fed (B3)	33.78	41.06	31.32	106.16	34.53	34.89	29.00	98.42	32.91	42.06	22.40	97.37	30.83	37.78	23.40	92.01
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	3.41	2.22	2.93	4.24	3.61	3.06	3.62	7.21	3.62	3.05	2.20	6.08	3.61	2.83	3.44	5.88
Interactions (AXB)																
A1B1	NS	34.9	24.67	-	24.00	27.66	20.00	-	NS	32.00	16.67	-	NS	30.66	16.33	-
A1B2	NS	38.96	29.00	-	30.33	31.57	28.00	-	NS	40.00	21.00	-	NS	36.67	19.00	-
A1B3	NS	41.67	31.50	-	31.63	32.33	30.00	-	NS	40.500	20.03	-	NS	37.63	20.03	-
A2B1	NS	39.53	28.67	-	30.30	35.00	29.33	--	NS	40.00	22.00	-	NS	36.00	23.33	-
A2B2	NS	44.90	36.27	-	38.87	41.00	32.67	-	NS	46.67	25.67	-	NS	41.33	29.00	-
A2B3	NS	46.86	35.33	-	43.96	40.00	31.00	-	NS	46.50	26.46	-	NS	42.50	29.87	-
A3B1	NS	27.00	22.00	-	21.73	21.66	19.66	-	NS	31.67	16.00	-	NS	29.33	15.00	-
A3B2	NS	30.33	23.500	-	24.33	27.33	23.33	-	NS	38.00	20.67	-	NS	32.67	19.33	-
A3B3	NS	34.66	27.13	-	28.00	31.67	26.00	-	NS	39.17	20.70	-	NS	33.233	20.30	-
LSD 0.05	-	3.50	5.19	-	6.20	5.31	6.02	-	-	5.32	3.71	-	-	4.82	4.90	-

The interactions between seeding rates and nitrogen fertilizer rates were significant on fresh yield for all cuts in the two seasons except the 1st cut for Shandawel 1 in the two seasons and 1st cut for Saudian variety in the first season only. The heaviest mean fresh yield recorded from second seeding rate and second level of nitrogen or third level of nitrogen

Dry yield (kg/plot)

Data in (Table 4a) revealed that there were significant differences between seeding rates on dry yield (kg/plot) in the first and second seasons in all cuts and its accumulate yield for the two varieties.. The highest mean of dry matter accumulate yield (17.76, 17.18 and 17.55, 16.81 kg/plot) recorded from 20 kg/fed for the two varieties in the first and second seasons. These results are quite in line with those of Pena *et al*. (1994) and Ayub *et al*. (2007). The increment of dry matter yield with high planting density was due to the high number of plant/m^2 which compensates the lowest number of tillers/ plant recorded with high planting density

Data in (Table 4a) both seasons reached the significance of difference for nitrogen fertilizer rates on dry yield for two varieties. The highest means (16.84, 16.35 and 16.30, 15.88 kg/plot).of dry yield recorded from the plots which received 120 kg N/fed. in the two seasons for two varieties. The increase of yield with increasing nitrogen dose was reflecting of the growth being promoted by nitrogen which is reflected on fresh yield and dry. Similar result was obtained by Ibrahim *et al.* (2014) who reported higher yields of dry with increasing levels of nitrogen.

The interactions between seeding rates and nitrogen fertilizer rates were significantly affected dry yield for all cuts for two varieties except 1st cut for Shandaweel 1 in the 1sdt season and 1st and 2nd cuts for Shandaweel 1 and 1st cut for Saudain varieties in the second one. Moreover the interactions between 20 kg seeding rate and 90 or 120 kg N/fed recorded the highest mean of dry matter yield /plot (Table 4a).

Table 4a. Effect of seeding rates (kg/fed), nitrogen fertilizer levels (kg/fed) and its interactions on dry yield (kg/plot) of two pearl millet varieties in 2016 and 2017 growing seasons.

Treatment	Dry yield (kg/plot)															
	Shandaweel 1 variety				Saudian variety				Shandaweel 1 variety				Saudian variety			
	2016								2017							
	Cut1	Cu2	Cut3	Accu. yield	Cut1	Cu2	Cut3	Accu. yield	Cut1	Cu2	Cut3	Accu. yield	Cut1	Cu2	Cut3	Accu. yield
15 kg/fed (A1)	4.51	6.05	4.65	15.21	4.40	4.89	4.32	13.61	4.39	6.16	3.39	13.94	4.15	5.97	3.28	13.40
20 kg/fed (A2)	5.32	6.83	5.61	17.76	5.99	6.33	5.23	17.55	5.39	7.35	4.44	17.18	4.95	6.94	4.92	16.81
25 kg/fed (A3)	4.16	4.92	4.05	13.13	3.95	4.49	3.98	12.42	3.94	6.12	3.54	13.60	4.25	5.6	3.35	13.20
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	0.54	0.40	0.46	0.68	0.58	0.51	0.60	1.18	0.39	0.72	0.55	1.05	0.36	0.47	0.38	0.77
N:fertilizer levels (B):																
60kg/fed (B1)	4.13	5.32	4.08	13.53	3.94	4.51	3.8	12.25	3.86	5.55	3.19	12.60	3.67	5.46	3.22	12.35
90kg/fed (B2)	4.76	6.04	4.92	15.72	4.87	5.44	4.74	15.05	4.78	6.91	4.07	15.76	4.76	6.39	4.05	15.20
120 kg/fed	5.09	6.44	5.31	16.84	5.54	5.77	4.99	16.30	5.09	7.16	4.1	16.35	4.92	6.67	4.29	15.88
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	0.53	0.42	0.48	0.66	0.59	0.53	0.64	1.20	3.38	0.73	0.53	1.03	0.56	0.42	0.56	00.93
Interactions (AXB)																
A1B1	NS	5.47	3.94	-	3.63	4.37	3.19	-	NS	5.07	2.87	-	NS	5.19	2.84	-
A1B2	NS	6.18	4.77	-	4.60	5.08	4.71	-	NS	6.57	3.72	-	NS	6.24	3.39	-
A1B3	NS	6.48	5.24	-	4.98	5.24	5.08	-	NS	6.84	3.59	-	NS	6.49	3.62	-
A2B1	NS	6.25	4.71	-	4.74	5.60	4.86	--	NS	6.38	3.84	-	NS	6.13	4.13	-
A2B2	NS	7.12	6.06	-	6.13	6.67	5.52	-	NS	7.73	4.64	-	NS	7.14	5.23	-
A2B3	NS	7.12	6.06	-	7.12	6.72	5.32	-	NS	7.92	4.84	-	NS	7.56	5.43	-
A3B1	NS	4.24	3.60	-	3.46	3.56	3.34	-	NS	5.21	2.87	-	NS	5.05	2.69	-
A3B2	NS	4.81	3.92	-	3.90	4.57	4.02	-	NS	6.44	3.86	-	NS	5.79	3.53	-
A3B3	NS	5.71	4.61	-	4.50	5.36	4.61	-	NS	6.72	3.88	-	NS	5.96	3.82	-
LSD 0.05	-	0.69	0.79	-	1.02	0.897	1.05	-	-	1.24	0.96	-	-	0.66	0.84	-

Chemical constituents:

Data in Table (5) show the effect of seeding rates and nitrogen fertilizer and its interactions on CP%, CF% and ash content% for two varieties under the study. Data illustrated in Table (5) that there were significant differences of seeding rate on the studied chemical constituents on all cuttings except crude fiber in the second cut for Shandaweel 1. The highest mean of crude protein recorded from the rate of 25 kg/fed at the various cutting which achieved (11.60, 10.27, 9.08 and 14.48, 12.88, 10.41%) for the two varieties, respectively). It this obvious that the protein percentage decreased with advanced cutting. Whereas, The lowest crude protein (10.52, 8.27, 7.34 and 13.36, 11.73, 8.97%) for the two varieties. achieved from the rate of 15 kg/fed. These results agreed with Pasternak *et al.* (2012) while, Ayoub *et al.* (2007) reported that The effect of seed rate on CP% contents was not significant but decreased with increased seed rate.

Regarding the effect of N fertilizer rates on crude protein percentage, the results in Table (5) indicated significant differences between the different rates of N fertilizer. Results showed that there were significant increases in crude protein, by increasing the N rate. This finding hold true in all cuts. The increase in crude protein contents with the application of nitrogen fertilizer has been reported by Ayub *et al.* (2002).

The interaction between seeding rates and nitrogen ferterilizer was significant for all cutting for the two varieties except 1st and 2nd cuts.

Regarding to the effect of the studied factors under the study on CF%, there were significant difference in all cuts except second cut for Shandaweel 1. The highest crude fiber percentage in all cuts recorded from the third cut from 15 or 20 kg/fed. Crude fiber increased with advanced cutting, The lowest crude fiber percentage refers to 25 kg/fed. Crude fiber is one of the most important parameter influencing the quality of fodder crops. The crude fiber contents increase with the age of the plant. The higher the crude fiber contents lower will be the digestibility. The results are quite in line with those of Ayub *et al.* (2002)

Data in aforementioned table show that there were significant differences of nitrogen fertilizer on crude fiber percentage. The highest crude fiber recorded from 90 or 120 kg N/fed. These data area in agreement with Ayub *et al.* (2007).

With regrard to the effect of the studied factor on ash content percentage. There was significant difference of seeding rate on ash content percentage (Table 5). The highest mean of ash recorded from 15 kg/fed while the lowest mean recorded from 25 kg/fed under the three cuts for the two varieties. The highest mean recorded from the plots which received nitrogen fertilizer at the rate of 90 kg N/fed for the two varieties. These results are in agreement with Tariq (1998) who reported significant effect of nitrogen application significantly affected ash contents percentage.

The interaction of seeding rate and nitrogen fertilizer on CP% was significant only in cut1, while in CF% was significant in all cuts, in addition the significance did not reach the significant only in the first cut of ash content for Shandaweel 1. Moreover, CP and CF did not significantly affected by the interaction between seeding rates and nitrogen fertilizer in the 1st and 2nd cuts for Saudian variety. the interaction between seeding rate and nitrogen fertilizer significantly affected ash content for the two varieties in all cuts except Shandaweel 1 in the first cut.

Table 5. Effect of seeding rates,(kg/fed), nitrogen fertilizer levels (kg/fed) and its interactions on CP%, CF% and Ash content of two pearl millet varieties in 2017 growing season.

Treatment	Shandaweel 1 variety									Saudian variety								
	CP%			CF%			Ash			CP%			CF%			Ash		
	Cut1	Cut2	Cut3	Cut1	Cut2	Cut3	Cut1	Cut2	Cut3	Cut1	Cut2	Cut3	Cut1	Cut2	Cut3	Cut1	Cut2	Cut3
Seeding rate (A)																		
15 kg/fed (A1)	10.52	8.72	7.34	36.03	36.99	39.42	7.91	8.15	9.57	13.36	11.73	8.97	34.60	37.07	38.29	7.53	7.48	9.01
20 kg/fed (A2)	11.47	9.72	8.04	6.47	36.71	40.16	7.17	8.50	9.46	14.21	12.69	9.56	35.27	35.79	39.69	6.64	7.89	8.75
25 kg/fed (A3)	11.60	10.27	9.08	34.48	36.72	37.31	6.80	7.72	9.27	14.48	12.88	10.41	34.02	36.27	36.83	6.52	6.85	8.48
F-test	*	*	*	*	NS	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	1.13	1.18	0.86	0.84	-	0.32	0.84	029	0.21	0.61	1.17	0.29	0.64	1.25	0.36	0.85	0.80	0.35
N:fertilizer levels (B):																		
60 kg/fed (B1)	9.00	7.49	6.19	35.11	35.71	38.00	6.34	7.32	9.04	12.58	10.48	7.79	32.90	36.34	36.50	6.28	6.37	8.64
90 kg/fed (B2)	11.03	9.12	7.69	35.89	37.76	38.92	7.01	8.77	9.79	14.13	12.22	9.53	34.40	36.85	38.39	6.80	8.25	9.04
120 kg/fed (B3)	13.6	12.100	10.57	35.99	36.98	39.98	8.52	8.29	9.47	15.33	14.58	11.62	36.58	35.94	39.93	7.62	7.60	8.56
F-test	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LSD 0.05	1.10	1.14	0.82	0.84	0.95	0.32	0.83	0.29	0.22	0.61	1.13	0.28	0.64	1.22	0.36	0.84	0.80	0.35
Interactions (AXB)																		
A1B1	8.90	NS	NS	34.85	35.68	38.55	NS	6.94	8.97	NS	NS	7.28	NS	NS	36.33	6.83	6.09	8.58
A1B2	9.08	NS	NS	35.89	36.30	39.22	NS	8.49	9.28	NS	NS	8.45	NS	NS	38.63	7.25	8.12	9.032
A1B3	13.59	NS	NS	37.35	39.00	40.50	NS	9.03	10.48	NS	NS	11.18	NS	NS	39.93	8.52	8.23	9.43
A2B1	9.02	NS	NS	35.53	35.80	38.83	NS	8.15	9.17	NS	NS	7.80	NS	NS	36.69	6.05	6.95	9.00
A2B2	11.86	NS	NS	36.36	38.66	4024	NS	10.14	11.08	NS	NS	9.36	NS	NS	39.83	6.58	9.72	9.78
A2B3	13.53	NS	NS	37.53	35.70	41.43	NS	7.23	8.13	NS	NS	11.34	NS	NS	42.57	7.30	6.99	7.48
A3B1	9.09	NS	NS	34.95	35.65	36.63	NS	6.88	8.98	NS	NS	8.28	NS	NS	36.49	5.96	6.08	8.35
A3B2	12.13	NS	NS	35.40	38.32	37.31	NS	7.70	9.01	NS	NS	10.60	NS	NS	36.73	6.57	6.90	8.33
A3B3	13.58	NS	NS	33.09	36.20	38.00	NS	8.60	9.80	NS	NS	12.34	NS	NS	37.28	7.04	7.59	8.78
LSD 0.05	2.03	-	-	1.460	0.52	0.38	-	1.46	1.64	-	-	1.46	-	-	1.38	1.07	0.63	0.61

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أداء صنفين من دخن العلف تحت تأثير معدلات التقاوى والتسميد النتروجينى

شريف عيدالغنى أبوالجود و ماجده نادى رجب

قسم بحوث محاصيل العلف ، معهد بحوث المحاصيل الحقلية مركز البحوث الزراعية جيزه، مصر

أقيمت تجربتان حقليتان بمزرعة محطة البحوث الزراعية بسدس محافظة بنى سويف خلال الموسم الصيفى 2016 و 2017 بدراسة تأثير معدلات التقاوى والتسميد النتروجينى على صنفين من دخن العلف شندويل 1 و الدخن السعودى . وتم تعريف الصنف السعودى بقسم التقسيم والفلورا بالمتحف الزراعى بالدقى وكان (*Pennsitium glaucum (L) R. Br. : Syn. Pennsitium americanium* (L) Fam. Poaceae). نفذت التجربة بتصميم القطع المنشقة مرة واحدة بثلاثة مكررات. اظهرت النتائج أن معدل التقاوى 25 كجم/ف والتسميد ب 120 كجم ن/ف أحقق أعلى القيم لكلا الصنفين تحت الدراسة وتفوق الصنف المحلى على السعودى لصفة طول النبات . حقق الصنف السعودى أعلى القيم عن الصنف المحلى لصفة نسبة الأوراق/للسيقان تحت معدل تقاوى 20 كجم/فدان والتسميد ب 120 كجم ن/ف . تفوق الصنف المحلي على السعودى لصفة قطر الساق تحت معدل 20 كجم/ف والتسميد بمعدل 120 كجم ن/ف .و أشارت النتائج إلى تفوق الصنف المحلى علي السعودى لصفتى البمحصول الأخضر والجاف/قطعة التجريبية وذلك عند استخدام معدل 20 كجم تقاوى للفدان والتسميد ب 90 أو 120 كجم ن/ف. حقق الصنف السعوي تفوقاً تحت معدل 20 كجم بذور/فدان والتسميد ب 90 أو 120 كجم/ف أعلى قيم البروتين بينما حقق الصنف المحلى أعلى قيم لألياف والرماد الخام عن الصنف السعودى تحت نفس المعدل السابق.