

Effect of Nitrogen and Phosphorus Fertilization on Yield and Some Growth Parameters of Sudangrass (*Sorghum sudanese*) Crop

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Abstract

A field experiment was conducted to study the effect of nitrogen (0, 200 and 300 kgNha⁻¹) and phosphorus (0, 60, and 180 kgPha⁻¹) fertilization and their combination on yield and some growth parameters of sudangrass (*Sorghum Sudanese*). (Number of leaves per plant, plant height, number of heads per plant, weight of 1000 seeds, yields of seeds, dry weight of shoots and protein content in seeds) were measured. Results indicated that nitrogen and phosphate application and their combination had significant effects on all growth parameters and yield of Sudangrass. The combination treatment of 300kgNha⁻¹ plus 180 kgPha⁻¹ gave higher yield (71.86 gm.plant⁻¹) and protein content in seeds (5.79 %) and other growth parameters.

Key words: Nitrogen, Phosphorus, Sudangrass, Chemical composition .

Introduction

Sudangrass (*Sorghum Sudanese*) is one of many important short-term forage crops of summer season, which is important for livestock farming (Li et al., 2011). The crop grows successfully in almost every type of soil, but it does best on loams. Sandy soil is generally unfavorable for crop production (Kilcer et al., 2002). Fertilizer requirements of sudangrass are usually similar to those of other annual grass crops. Nitrogen is the most limiting nutrient in Sudangrass production. The direct response of the plant to nitrogen fertilizer is increasing in green forage yield and protein content. Also N enhances the

growth of shoot and makes the fodder juicy that is essential for fodder crop (Khalied and Muhammad, 2003). Kilcer et al., (2002) found that Nitrogen application increased yield of Sudangrass and improved its yield components. Nitrogen application significantly increased total green biomass, protein content and nitrogen concentration of leaves of Sudangrass (Hazary et al., 2015).

Phosphorus fertilizer has affected sudangrass production both in quality and quantity (Vashishatha and Dwivedi, 1997). Phosphorus moves slowly in soil, so applying it before planting is necessary for plant

growth (Keshwa and Jat,1992).It is important of energy component (ATP, Adenosine triphosphate, and ADP, Adenosine diphosphate) (Mengel and Kinkby,1982).Hazary et al.,(2015) found significant effect of P fertilization on yield of Sudangrass planted in Bangladesh .

Information regarding the optimum level of N and P and their effective combination on sudangrass growth and productivity is rare. The objective of this study was to evaluate the effect of different levels of nitrogen and phosphorus fertilizer on yield and some growth parameters of Sudan grass planted in calcareous soil in Basrah.

Materials and Methods

The experiment was carried out in a private field in Abul-Khasseb , Basrah province during the 2014-2015 season. Soil samples properties were taken and analyzed according the method described by Black (1965) ; Jackson(1958) ; and Page et al.,(1982) (table 1) .

Three different levels of nitrogen (0,200,and 300)kgNha⁻¹ as urea fertilizer(46%N),and three levels of phosphorus (0,60,and 180 kg Pha⁻¹)as concentrated super phosphate (20.21%P), and their combination were used to investigate their effects

on some growth parameters and yield of Sudangrass . The experimental design used was a complete randomized block design with a split plot in three replicates .Nitrogen treatments were represented a main blocks ,while a phosphate treatments were presented a sub treatment. A seeding rate Of kgha⁻¹.Seeds were sown in row. The experimental design was plot (3*4m) and divided to rows . The space between row was 30cm. Phosphate fertilizer and first dose of nitrogen were added as broadcasting of rows at planting date 1st April 2014. The second dose of nitrogen was added after one month of planting with irrigation water. Growth parameters such as number of leaves, plant height(cm),number of seeds, and weight of 1000 seeds were measured before harvest (1st Aug.2014). Dry weight of shoots was taken after drying in oven at 65⁰C .Yield of seeds was taken for each treatment. Protein content was calculated according to the method mentioned by Crasser and Parson (1979). Comparisons between means were made using least significant differences (L.S.D.) test at 5% levels of probability by using SPSS program version(16).

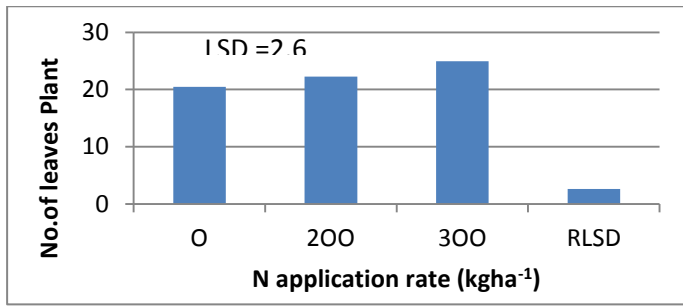
Table (1) : Some chemical and physical properties of the field soil .

Property	Value	Unit
pH	7.28	-
Electrical Conductivity (EC _e)	5.80	dSm ⁻¹
Cation Exchange Capacity (CEC)	26.20	meq.kg ⁻¹
Calcium Carbonate	335.63	gm.Kg ⁻¹
Organic matter	11.70	
Total Nitrogen	1.79	
Available Nitrogen	22.50	gm.Kg ⁻¹
Available Phosphate	15.45	
Soil Particles		gm kg ⁻¹
Sand	91.5	
Silt	513.5	
Clay	395.0	
Soil texture		silty clay loam

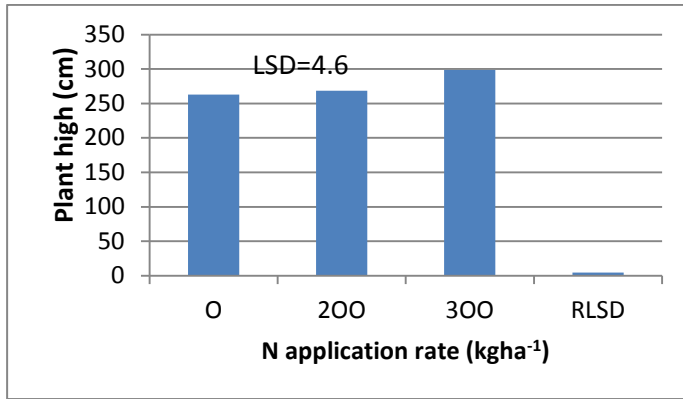
Results and Discussion

Results in figures(1and 2) showed significant effect of nitrogen application on growth parameters studied of Sudangrass. Highly significant effect of N application was found at 300 kg N ha⁻¹ for all growth parameters . Maximum yield of seed was obtained at 300 kg N ha⁻¹ (66.22 gm.plant⁻¹) with increasing percentage 25% and 30 and 8.15% for 200kg N ha⁻¹ and control treatments . Protein content in seeds reached 5.107% for 300kg N ha⁻¹

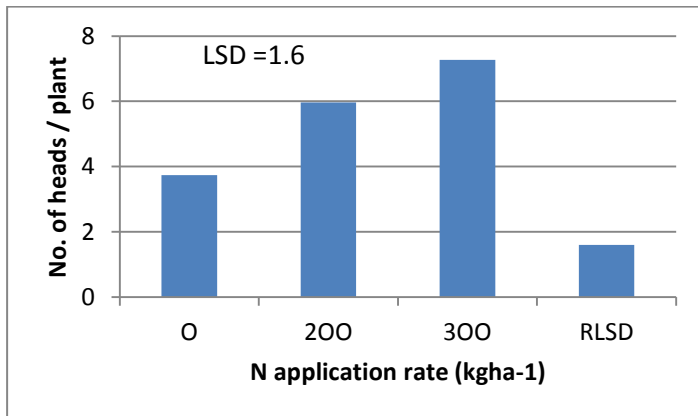
level with increasing percentage of 10.37% , and 32.75% for 200 kg N ha⁻¹ levels as compared with control treatment. This mean that applying large quantities of nitrogen has significant effect on Sudan grass yield and supplying plant with sufficient quantity of plant growth by increasing of available nitrogen in soil which might have enhanced growth of Sudan grass . These results agreed with the results of Hazary et al.,(2015).



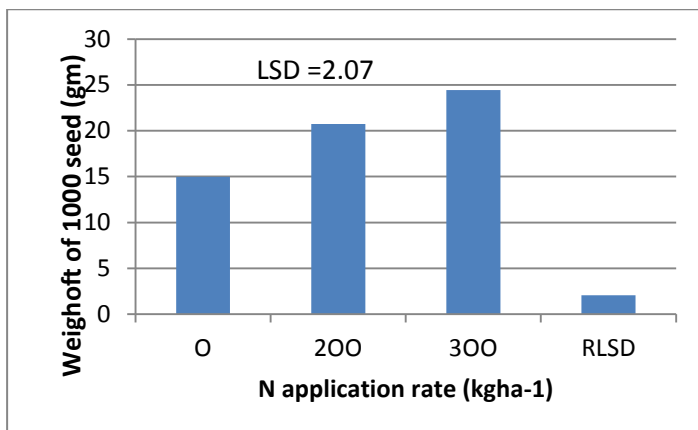
(A)



(B)

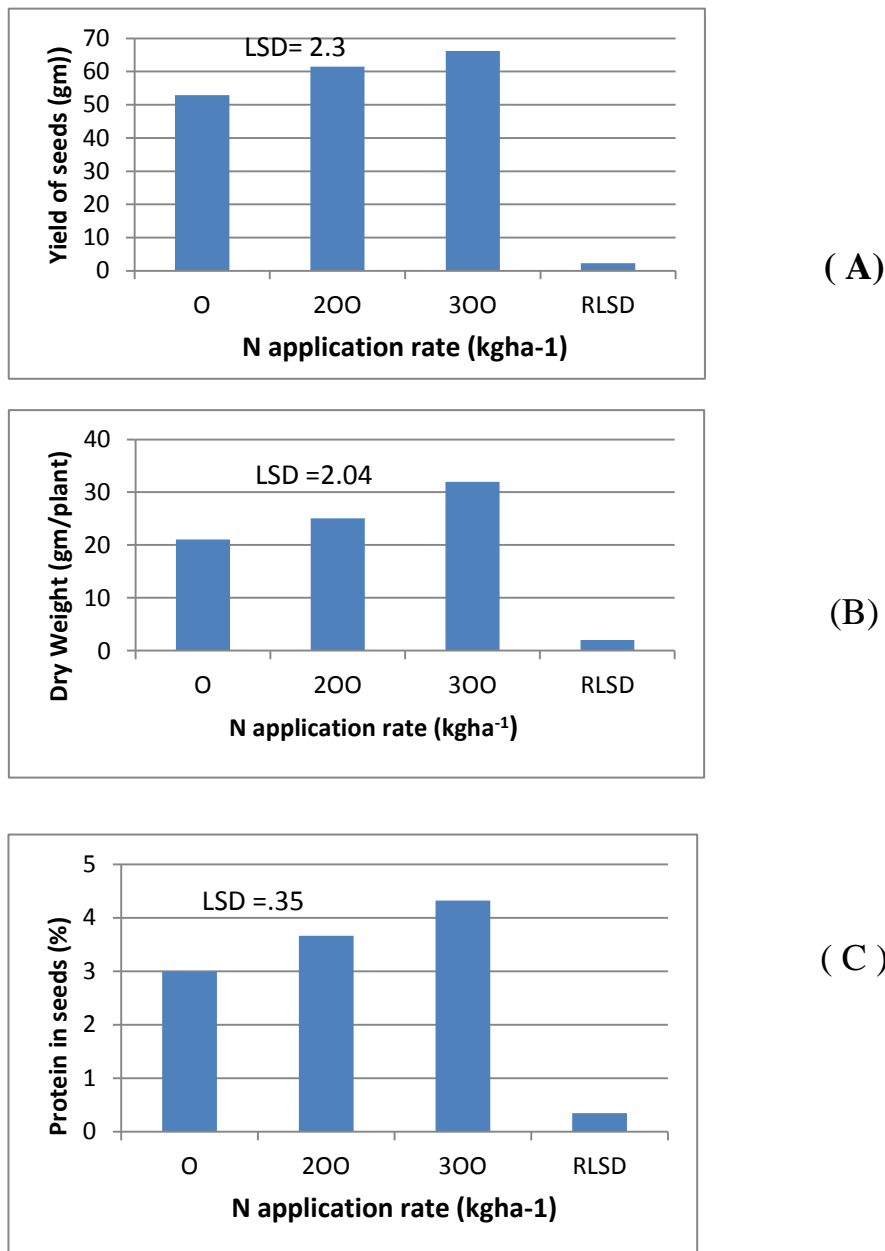


(C)



(D)

Fig(1): Effect of N application on number of leaves per plant(A) , plant height (B), number of heads per plant (C) and weigh of 1000 seed (D)of Sudangrass



Fig(2): Effect of N application on yield of seeds (A), dry weight (B) and protein content in seeds (C) of Sudangrass

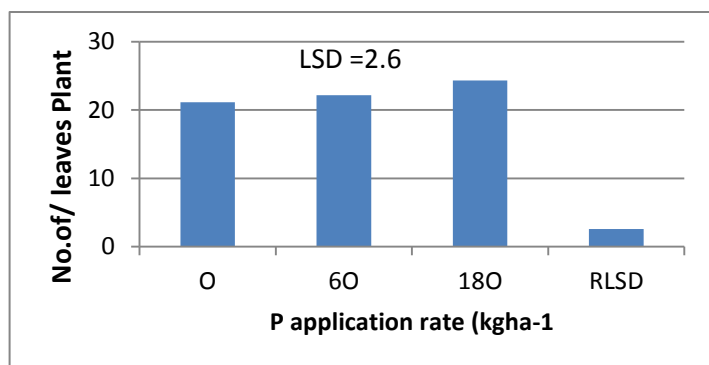
Significantly ($P < 0.05$) effect was observed when applying phosphorus at 60 and 120 kg P ha⁻¹ on growth parameters, yields, seeds and protein when compared with control treatment (Figs 3 and 4). This means that applying phosphate fertilizer increased available phosphate in soil and its uptake by plant. Yield of Sudangrass seeds at different P fertilizer treatment was 54.16, 60.35 and 66.05 gm plant⁻¹ in respect to

control treatment respectively, while protein content for the same treatments was 3.993, 4.433, and 5.063% respectively. Phosphate increased root growth and its development and increased of nutrients uptake (Vashishathan Dwived, 1997). Similar result was found by Khaleduzzman et al., (2007).

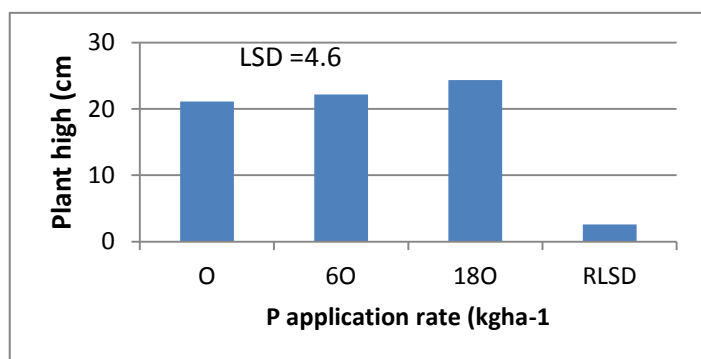
Results in table 2 showed the combination effect of nitrogen and

phosphate fertilization on growth parameters , yields and protein content of Sudangrass seeds . Statistical analysis showed significant (0.05) effect due to the combination of nitrogen and phosphate fertilization . Highest number of leaves , plant height , numbers of heads, weight of 1000 seed, yield of seeds , dry matter, and protein content in seeds was reached at the (300 kg N ha⁻¹ plus 180 kg P ha⁻¹)combination treatment as compared with other treatments , which were(26 00 leaf.plant,341.66 cm, 7.83 head .plant⁻¹ , 26.04 gm,

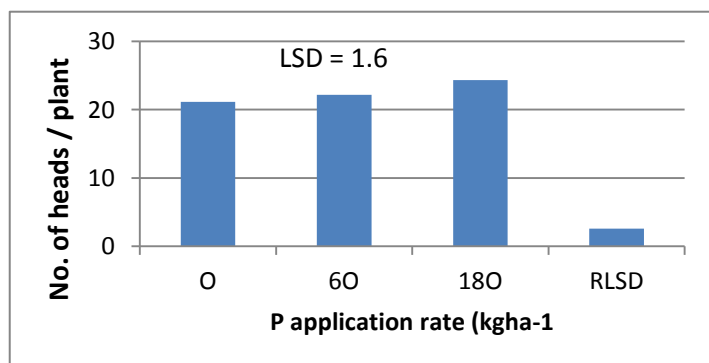
71.86 gm.plant⁻¹,34.1o gm plant-1 , and 5.790%)respectively .Similar result were stated by Awan and Abbasi (2000) who found that increasing levels of P and N fertilizers increased nitrogen and phosphate uptake by Sudangrass .This results indicate that protein content and yields of Sudangrass seeds increased significantly with the increase of N of P fertilization . The finding of this study can be used by farmers and research for fulfilling the production demand from Sudangrass in Iraq .



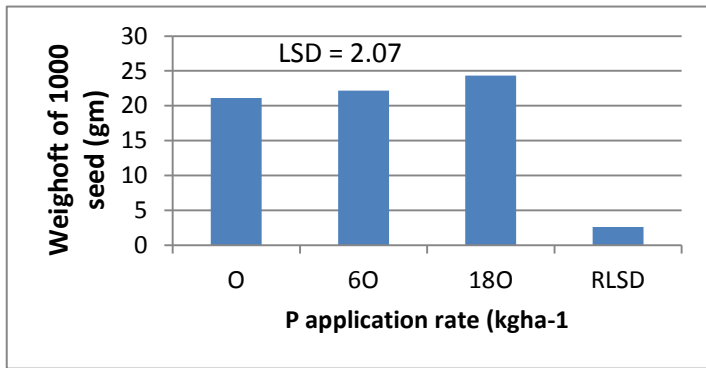
(A)



(B)

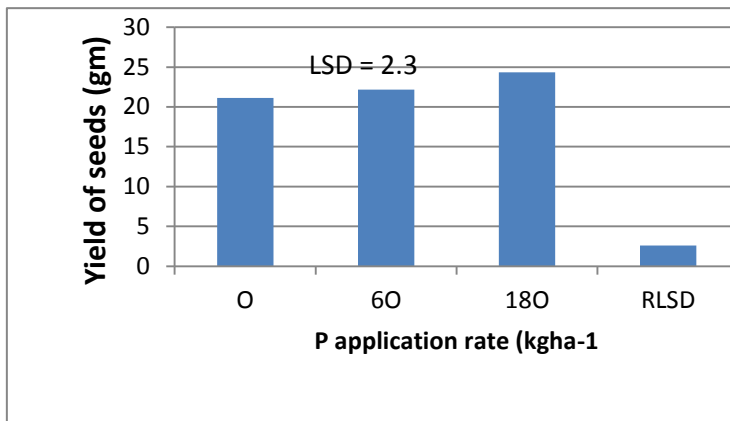


(C)

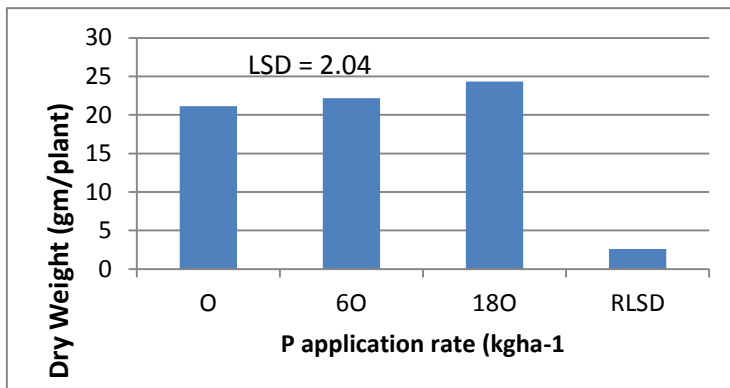


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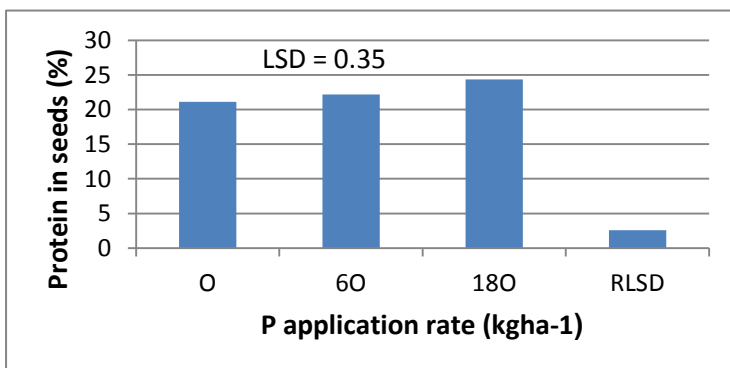
Fig(3): Effect of P application on (No. of leaves plant(A) , plant height (B), No. of heads . plant⁻¹(C) and weigh of 1000 seed (D) of Sudangrass



(A)



(B)



(C)

Fig(4): Effect of P application on yield of seeds (A), dry weight (B) and protein concentration in seeds (C) of) Sudangrass

Table(2) : Effect of nitrogen and phosphate fertilization and their combination on some growth parameters and yield of Sudangrass.

Treatments	No.of leaves . plant ⁻¹	Plant Height (cm)	No. of Heads .plant ⁻¹	Weight. of 1000 seed (gm)	Yield of seeds (gm)	Dry.matter gm .plant ⁻¹	Protein in seeds (%)
Control	19.77a	260.89a	3.33a	13.51a	43.45a	19.83a	3.440a
N1	19.77a	263.33ab	3.58abc	15.42a	53.11b	20.41a	3.900a
N2	21.84ab	264.88ab	4.30abc	16.03a	61.99d	22.88ab	4.200b
p1	19.91a	259.66a	4.33abc	16.31a	57.45c	22.83ab	4.180ab
P2	21.66ab	274.44c	6.08bc	21.35b	62.76d	25.07bc	4.500c
N1p1	27.20b	270.83bc	7.49cd	24.54bc	64.30d	27.20c	5.200e
N1p2	23.66ab	276.55c	6.61a	22.55bc	61.62d	28.17c	4.360c
N2p1	25.10b	277.77c	7.37d	24.77bc	65.17d	33.66d	4.900d
N2P2	26.00b	341.66d	7.83d	26.04c	71.86e	34.10e	5.790f
LSD(0.05)	4.577	7.980	2.901	3.595	4.13	3.544	0.149

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تأثير التسميد النتروجيني والفوسفاتي في الحاصل وبعض مؤشرات النمو لحصول

الحشيش السوداني (*Sorghum Sudanese*)

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الخلاصة

نفذت تجربة حقلية لدراسة تأثير التسميد النتروجيني (صفر، 200، 300 كغم نتروجين هكتار⁻¹) والفوسفاتي (صفر، 60، 180 كغم فسفور هكتار⁻¹) والتداخل بينهما في حاصل وبعض مؤشرات النمو (عدد الاوراق نبات⁻¹، ارتفاع النبات، عدد الروؤس نبات⁻¹، وزن 1000 حبة، حاصل الحبوب، الوزن الجاف للمجموع الخضري ومحتوى البروتين في الحبوب) لمحصول الحشيش السوداني المزروعة في تربة طينية مزيجية غرينية في احد حقول محافظة البصرة في ابي الخصيب خلال الموسم 2014-2015. بينت النتائج بأن للتسميد النتروجيني والفوسفاتي والتداخل بينهما تأثير معنوي في حاصل الحبوب لمحصول الحشيش السوداني وجميع مؤشرات النمو وقد حققت المعاملة (300 كغم نتروجين هكتار⁻¹ + 180 كغم فسفور هكتار⁻¹) اعلى انتاج للحبوب (71.86 غم نبات⁻¹) واعلى تركيز للنتروجين اذ بلغ 5.79% هذا بالإضافة الى مؤشرات النمو الاخرى .

الكلمات المفتاحية : التسميد النتروجيني والفوسفاتي ، الحشيش السوداني .