

EFFECT OF DIFFERENT LEVELS OF NITROGEN AND PHOSPHORUS FERTILIZERS ON GROWTH AND YIELD OF SORGHUM

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Abstract

Field experiment was conducted in the Abu-Alkassibe sheeb (Basrah Governorate), during the fall season of 2002, to study the effects of nitrogen fertilizer levels (0, 120, 160 and 240) kg N.ha⁻¹ and phosphorus fertilizer levels (0, 40, 80) kg P.ha⁻¹ on growth and yield of sorghum.

Results indicated that increase of nitrogen fertilizer to 240 kg.ha⁻¹ lead to significant increasing in plant height, stem diameter, leaf area index, green fodder yield, number of grain per head, weight of 1000 grain and grain yield. The level 80 kg. ha⁻¹ of phosphorus fertilizer gave high plant height, stem diameter, leaf area index number of grain per head. The interaction between nitrogen and phosphorus fertilizers were no significant.

Introduction

Sorghum is one important cereal crops, the purpose of its use is for green fodder, dry dry and silage, its grains used to product for animals ration with 50% percentage.

Mineral nutrition consider necessary for increasing of growth and production, many researchers refer to importance of nitrogen fertilizer and its effect on plant height, leaf area. Leaf area duration and period of grain filling (Neil, 1989). Mohammed and Mohammed (1988) stated that 160 kg N ha⁻¹ gave a significant increasing in plant height, stem diameter and fodder yield than to 0 and 80 kg N. ha⁻¹. Hibberd *et al.*, (1991) reported that high grain yield obtained in 50 kg N ha⁻¹ and 20 kg P ha⁻¹ for two hybrids E57 and Gold finger. Mustafa (1995) observed significant increasing in leaf area index and plant height with increase of nitrogen fertilizer from 43 to 129 kg N ha⁻¹, Kamoshita *et al.* (1998) indicated a significant increasing in number of grain per head and grain yield with increase of nitrogen fertilizer from 60 to 240 kg N ha⁻¹. High fodder and grain yield obtained from interaction between 100 kg N ha⁻¹ and 10.5 kg P ha⁻¹, protein content (%) in 100 kg N ha⁻¹ and 21 kg P ha⁻¹ (Ayub *et al.*, 1991). The level of 20 kg N ha⁻¹ and 10 kg P ha⁻¹ producted high grain yield (Chakkarine and Manat, 1999). Kamoshita *et al.*, (1999) refered to significant increasing in number of grain per head, grain weight and grain yield in 60 kg N ha⁻¹ comparding without application.

The purpose of this study was to investigate the effect of nitrogen and phosphorus fertilizers in growth and yield of sorghum.

Materials and Methods

Field experiment was conducted at the Agricultural Field area of the Abu-Alkassibe sheeb (South East Basrah Governorate) during the fall season of 2002 to investigate the effects of four levels of nitrogen fertilizer (0, 120, 180 and 240 kg N ha⁻¹) and three levels of phosphorus fertilizer (0, 40 and 80 kg P ha⁻¹) on growth and yield of the sorghum cultivar khafeer-2. Nitrogen fertilizer was added in two equal split application at planting time and 50% flowering as urea (46% N). Phosphorus fertilizer was added at planting time as super phosphate fertilizer (46% P₂O₅).

Factorial experiment was carried out by using R.C.B design with three replications. Plot size was 12m² (4 m in length and 3 m in width). The distance between each row was 75 cm apart. Hills were spaced 10 cm apart. Each plot consisted of four rows. To avoid the interference between treatments, 1.5 m beds were left among experimental plot. Sorghum grains were sown on 15th of June. After three weeks, plants were thinned to one plant per hill. All plots were irrigated after planting. Hand weeding was done after planting when needed.

At 50% flowering, ten plant were randomly taken from each plot for determination of the growth characteristics (plant height (cm), stem diameter (cm), leaf area index and green fodder yield).

At harvested, number of grains per head and weight of 1000 grain calculated by thrashing the five randomly selected plants in each plot. Grain yield was obtained from the center, 2 m from each of two rows, heads were had harvested and thrashed.

The analysis of variance described by Elsahookie and Wuhaib (1990) was followed. The revised L.S.D. test was used to variety the significance between treatment means.

Table (1) : Physical and chemical characteristics for the soil of experiment

Soil texture	Clay loam
pH	7.32
Electrical conductivity dS/m (Ec)	8.36
Available phosphorus gm.kg ⁻¹	0.013
Total nitrogen gm.kg ⁻¹	0.036
CaCO ₃ gm.kg ⁻¹	32.4
Organic matter gm.kg ⁻¹	0.54

Results and Discussion

Nitrogen fertilizer

Growth characteristics

Results indicated that there is a significant effect of nitrogen fertilizer levels on the studied growth characteristics which studied. There is an increasing in characteristics with increasing of nitrogen fertilizer. The highest mean of plant height (159.55cm) was noticed with 240kg N.ha⁻¹ comparing the levels 0,20, 180 kg N.ha⁻¹. The stem diameter was 2.11 and 1.95 cm. with the levels 240 and 180 kg N.ha⁻¹ respectively. The application of 240 kg N.ha⁻¹ gave significant increases in leaf area index and green fodder yield than with 0, 120, 180 kg N.ha⁻¹, there were 5.23 and 47.10 ton. ha⁻¹ for two trails respectively (Table 2). The reason of increasing in growth with increasing of nitrogen fertilizer is the effect of nitrogen element on the biological processes which take place in the plant, its an necessary element in building of amino acid tryptophan which uses in the formation of auxin and the later play an important role in the elongation of plant and increase the activation of meristem cell, so the leaf area will be increase due to increasing cell divition. More over the growth of roots will be increase, that causes increasing in the absorption efficiency of water and mineral and then increasing the vegetative growth which correlate with green fodder yield. These results was similar to that (Neil, 1989 and Mohammed and Mohammed, 1988).

The yields and its components

Results indicated that the nitrogen fertilizer level of 240 kg N.ha⁻¹ gave significant increasing in the number of grain per head and weight of 1000 grain than

the other level of nitrogen fertilizer. The mean of number of grains per head was 1664.02, and the mean of weight of 1000 grain was 28.69 g, this may be due to the formation of efficient source for interception of light which increase formation of more flowers and grains per head and efficient sink over because of reduce the competition between the flowers through period of grains filling and increasing in the metabolite to the sink (grain) by increasing the source (leaf area index), also the N-fertilizer act as a factor to increase the number and size of endosperm cells in the grains through the first days of fertilization and obtained efficient source which receive more amount of metabolite and then increase the grain weight. These results was similar to that of Komashata *et al.*, (1999), who noticed a significant increasing in number of grain per head and grain weight by the level of N-fertilizer 60 kg N.ha⁻¹ in contrast with the control (without application) on the other hand that the grain yield was more in the level 240 kg N.ha⁻¹ than the other levels, which was 5.73 ton ha⁻¹. Results similar to that of Kamoshata *et al.* (1998) who noticed the significant increasing in number of grain per head and grain yield by the increasing of N-fertilizer level from 60 kg N.ha⁻¹ to 240 kg N.ha⁻¹, this may be by the increase of yield components (the weight of 1000 grain and number of grain per head).

Table (2) Effects of nitrogen fertilizer levels on some growth characteristics, yield and its components

Nitrogen fertilizer levels	Plant height (cm)	Stem diameter (cm)	Leaf area index	Fodder yield T.ha ⁻¹	Number of grains per head	Weight of 1000 grain (g)	Grains yield T.ha ⁻¹
0	117.44	0.97	2.14	23.68	1260.09	20.97	3.23
120	131.77	1.53	3.05	33.42	1429.33	21.78	3.86
180	145.99	1.95	4.11	38.08	1531.69	25.07	4.69
240	159.55	2.11	5.23	47.10	1664.02	28.69	5.73
L.S.D	29.66	0.31	0.73	6.08	78.60	2.75	0.92

Phosphorus fertilizers

Growth characteristics

From the results of statistical analysis it was noticed that there is significant effect of P-fertilizer on the characters of growth and showed that the level 80 kg N.ha⁻¹ is more effect and without significant difference about of 40 kg N.ha⁻¹. The level of 80 kg N.ha⁻¹ gives highest plant height (48.50 cm) and highest rat of stem diameter was 1.72 cm and the highest leaf area index was 3.81 (Table 3), but the three characters was reduced if there is no Phosphorus fertilizer, this is due to the role of phosphor in activation of biological processes in the plant (Al-Niemi, 1987). The results indicate that there is no effect of P-fertilizer on forage yield.

The yield and its components

The yield and weight of 1000 grain was not effected significantly with addition of P-fertilizer, but there is an significant effect on the number of head grain, which gives the level of 80 kg N.ha⁻¹ highest number of grain per head were 1500.94 grain per head (Table 3). This due to the role of phosphurs in increasing formation of flowers and grains. Results was differed with Hibberd *et al.*, (1991) and Ayub *et al.*, (1999) who noticed not significant effect for phosphorus fertilization on the yield.

The interaction between nitrogen and phosphorus fertilizer was not significant for all of the studied characteristics.

Table (3) Effects of phosphorus fertilizer levels in some growth characteristics, yield and its components

Phosphorus fertilizer levels	Plant height (cm)	Stem diameter (cm)	Leaf area index	Fodder yield T.ha ⁻¹	Number of grains per head	Weight of 1000 grain (gm)	Grains yield T.ha ⁻¹
0	131.16	1.55	3.44	23.65	1438.68	23.65	4.23
40	136.00	1.65	3.65	24.10	1474.23	24.10	4.32
80	148.50	1.72	3.81	24.14	1500.94	24.14	4.51
L.S.D	13.96	0.28	0.42	N.S	63.91	N.S	N.S

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تأثير مستويات مختلفة من السماد النيتروجيني والفوسفاتي في نمو وحاصل الذرة البيضاء

$$\begin{aligned} & \left(\frac{\text{N}}{\text{P}} \right) \\ & \left(\frac{\text{N}}{\text{P}} \right) \\ & \left(\frac{\text{N}}{\text{P}} \right) \\ & \left(\frac{\text{N}}{\text{P}} \right) \end{aligned}$$