International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979, Impact Factor: RJIF 5.72
www.allsubjectjournal.com
Volume 4; Issue 5; May 2017; Page No. 78-80

Effect of Nitrogen and Sulphur on growth and yield of Hybrid maize (*Zea mays* L.)

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Abstract
An experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Allahabad, (U.P) during *kharif* season of 2016. The study was conducted to find out the effect levelsof nitrogen and sulphur on growth and yield of hybrid maize (*Zea mays* L.). The experiment was laid out in RBD having 12 treatments replicated thrice and it consisted of 3 levels of nitrogen *viz.* 100kgN, 120kg N and 140kg N and 4 levels of sulphur*viz*. Control, 15kg S ha^{-1},30kg S ha^{-1} and 45kg S ha^{-1}. The experimental findings record that the maximum plant height (198.67cm), maximum plant dry weight (178.09g), LAI (5.16), length of cobs with and without husk (27.67cm and 20.83cm),respectively. Grain rows cob^{-1} (16.07) and grains row^{-1} (30.15), 1000 grain weight (238.67g) and grain yield (9717kg ha^{-1}) were recorded in treatment T_{11}(140 kg N ha^{-1}+ 30 kg S ha^{-1}) followed by treatment T_7 (120kgN ha^{1}+ 30 kg S ha^{-1}) and it was concluded that nitrogen and sulphur significantly influenced the growth parameters and yield of hybrid maize and higher level of sulphur*i.e.*45kgha^{-1}increased the cost of cultivation and also had antagonistic effect on yield attributes of maize.

Keywords: hybrid maize, nitrogen levels, sulphur levels, yield parameters

Introduction
Maize (*Zea mays L.)* is one of the most important cereal crops, next to rice and wheat and is used as a food for men and feed for animals.This crop has been developed into a multi dollar business in countries *viz*. Thiland, Tiwan, Singapore, Malaysia, USA, Canada and Germany, because of its potential as a value added product for export and a good food substitute (Mugalkhod, *et al*., 2011). Maize is gaining immense importance on account of its potential uses in manufacturing starch, plastics, rayon, adhesive, dye, resins, boot polish etc. and due to this large uses it is rightly called a Miraclecrop and also known as ʻQueen of cereals' due to its high potential yield. In India, maize is grown in an area of 9.43million hectares with production of 24.35 m t and productivity of 2583 kg ha^{-1}(Government of India, 2014**).**Maize yield is generally higher in high solar intensities, lower night temperatureand lower pest infestation (Adesoji, *et al.,* 2013). Optimum plant density leads to better utilization of solar radiation resulting into corn dry matter accumulation and biomass production (Moosari, *et al*., 2012). The production of maize in India is quite low as compared to the countries *viz*. Thiland, Tiwan, Singapore and USA. The probable reason may be due to nitrogen and sulphur deficiency of our soils. It has been reported by many workers that most of the Indian soils are deficient in sulphur.

Nitrogen is a vital plant nutrient and a major yield determining macronutrient for most of the cereals. It is very essential for plant growth, as it makes up 1 to 4 % of dry matter of the plants. It is a major component of proteins and nucleic acids. It is also an essential constituent of chlorophyll and many other enzymes (Onasanyes, *et al.,* 2009). Thus, availability of nitrogen in sufficient quantity throughout the growing season is essential for optimum growth and production of maize.

Sulphur, nowadays is considered as the 4th major plant nutrient after nitrogen, phosphorus and potassium (Nyborg and Bently, 1997). This nutrient helps the plant to perform many physiological functions like synthesis of sulphur containing amino acids *viz*. cysteine, cystine and methionine. It is also involved is various metabolic processes of plant. It is also a constituent of Glutathione, a compound supposed to be associated with the plant respiration and synthesis of essential oils. Sulphur also plays a vital role in chlorophyll formation. The plant requirement for sulphur is mainly responsible for nitrogen availability hence with the increasing rate of sulphur, the availability of nitrogen and it uptake increases (Metha, *et al.*, 2005). Keeping the above facts in view and to increase the production of maize in India, an experiment entitled "Growth and Yield of Hybrid Maize (*Zea mays* L.) asinfluenced by levels of Nitrogen and Sulphu" was conducted at SHUATS, Allahabad (U.P).

Materials and Methods
The experiment was conducted at CRF (Crop Research Farm), Department of Agronomy, SHUATS, Allahabad, U.P during *kharif*season of 2016. Geographically, the experimental site is located between 25^0 24′ 42″ North latitude and $81^0$50′ 56″ East longitude and at an altitude of 98m above the mean sea level. The soil of the experimental field was sandy loam in texture having organic carbon 0.93%, available nitrogen 190.3kg ha^{-1}, available phosphorus 22.5kg ha^{-1}, available potassium 87kg ha^{-1}.The pH and EC of the soil was recorded as 7.5 and 0.27m^{-1}respectively. The experiment was conducted in RBD

(Randomized Block Design) comprising of 12 treatments each replicated thrice. There were3 levels of nitrogen *viz.* 100, 120 and 140 kg $ha^{-1}$and 4 Sulphur levels *viz.* control, 15, 30 and 45 kg ha^{-1}. The variety of maize used was Champion 61(Hybrid) and the seeds were sown at a spacing of 60 × 20 cm using a seed rate of 20 kg ha^{-1}.

Result and Discussions

Growth Attributes

An appraisal of the Table no.1 reveals that growth parameter differed significantly among treatments. The plant height, dry weight, LAI, length of cobs with and without husk recorded maximum values in treatment T_{11}(140 kg N ha^{-1} + 30 kg S ha^{-1}) as 195.07 cm, 178.29 g, 5.16, 27.67 cm and 24.03 cm respectively followed by treatment T_7which was found to be at par to treatment T_{11} except LAI.

The probable reason for attaining maximum values of aforesaid parameters with nitrogen @140 kg N $ha^{-1}$was because thatnitrogen being major component of chlorophyll and proteins enhanced growth and development and hence produced plants with more leaf area and leaf area index (Kandif, 2013).The other reason may be due to better mineralization and availability of nitrogen to plants for plant metabolism which effect the physiological processes of the maize crop. It was also observed that sulphur levels had non-significant effect on growth parameters due to the fact that sulphur has no role in vegetative growth as it is a qualitative nutrient. However, length of cobs with and without husk recorded maximum values in treatment T_{11} may be due to optimum availability of nitrogen and sulphur and better translocation of these nutrients to the reproductive parts. These findings are in accordance to those of (Rasheed, *et al.*, 2004) [8], (Jeet, *et al.*, 2012) [3], (Qahar and Ahmad, 2015) [6] and (Alam, *et al.* 2003) [2].

Yield parameters

Grains $Row^{-1}$and Grain rows Cob^{-1}

A perusal of table no.2 reveals that number of grains rows cob^{-1} and grains row^{-1} show non-significant effect with respect to different levels of nitrogen and sulphur. However, maximum grain rows per cob (16.07) and grains row^{-1} (31.07) was recorded in treatment T_{11} followed by treatment T_7 (16.05 and 30.67) respectively. This may be due to larger cob size, proper pollination, translocation of sugars and starch and finally proper grain set due to higher nitrogen fertilizer dose and high nitrogen use efficiency and sulphur provides better nutrition to reproductive parts being a qualitative nutrient. These findings are in conformity to recommendation of (Alam, *et al.* 2003) [2].

1000 grain weight

A critical review of the table no. 2 clearly depicts that there was significant influence of nitrogen and sulphur on test weight of maize hybrid under study and maximum test weight (238.67g) was recorded in treatment T_{11} followed by treatment T_7(218.67g) and was found to be at par to treatment T_{11}. This increase in test weight was due to better seed setting and better translocation of sugars and starch as a result of increasing levels of nitrogen and sulphur application which enhanced crop growth rate, NAR and dry weight plant $^{-1}$,which ultimately increased test weight. Similar finding shave also been reported by Rasheed (2003).

Table 1: Growth and yield of hybrid Maize (*Zea mays* L.) as influenced by levels of Nitrogen and Sulphur

Treatments		Plant height(cm)	Dry Weight(g)	Leaf Area Index	Length of Cobs (cm)	
		80 DAS	80 DAS	80 DAS	With husk	Without husk
T_1	100 kg N ha^{-1} + 00 kg Sulphur ha^{-1}	181.97	155.67	4.56	22.3	17.2
T_2	100 kg N ha^{-1} + 15 kg Sulphur ha^{-1}	186.67	170.89	4.53	26.23	20.23
T_3	100 kg N ha^{-1} + 30 kg Sulphur ha^{-1}	184.47	113.51	4.74	26.4	20.47
T_4	100 kg N ha^{-1} + 45 kg Sulphur ha^{-1}	189.73	162.28	4.61	27.03	20.33
T_5	120 kg N ha^{-1} + 00 kg Sulphur ha^{-1}	180.43	150.03	4.14	21.23	17.77
T_6	120 kg N ha^{-1} + 15 kg Sulphur ha^{-1}	191.13	117.19	4.5	26.9	20.73
T_7	120 kg N ha^{-1} + 30 kg Sulphur ha^{-1}	194.97	172.86	4.83	27.43	20.83
T_8	120 kg N ha^{-1} +45 kg Sulphur ha^{-1}	188.67	164.01	4.71	26.13	20.13
T_9	140 kg N ha^{-1} + 00 kg Sulphur ha^{-1}	187.53	121.58	4.37	24.2	19.27
T_{10}	140 kg N ha^{-1} + 15 kg Sulphur ha^{-1}	192.2	165.75	4.45	27.37	20.67
T_{11}	140 kg N ha^{-1} + 30 kg Sulphur ha^{-1}	195.07	178.29	5.16	27.67	24.03
T_{12}	140 kg N ha^{-1} + 45 kg Sulphur ha^{-1}	194.7	171.58	4.76	27.37	20.47
F- test		S	S	NS	S	S
S. Ed. (±)		2.75	21.563	0.362	1.554	0.735
C. D. (P = 0.05)		5.676	44.505	-	3.207	1.516

Table 2: Growth and yield of hybrid Maize (*Zea mays* L.) as influenced by levels of Nitrogen and Sulphur

Treatments	Grain Rows $Cobs^{-1}$(No.)	Grains $Rows^{-1}$(No.)	1000 grain weight(g)	Grain yield (kg ha^{-1})	Treatments
T_1	100 kg N ha^{-1} + 00 kg Sulphur ha^{-1}	15	28.87	188.67	6858.67
T_2	100 kg N ha^{-1} + 15 kg Sulphur ha^{-1}	14.33	27.13	215.33	7528.00
T_3	100 kg N ha^{-1} + 30 kg Sulphur ha^{-1}	14.13	29.60	194.00	7636.00
T_4	100 kg N ha^{-1} + 45 kg Sulphur ha^{-1}	14.87	29.93	184.00	7655.33
T_5	120 kg N ha^{-1} + 00 kg Sulphur ha^{-1}	14.47	28.80	212.67	7152.67
T_6	120 kg N ha^{-1} + 15 kg Sulphur ha^{-1}	14.6	28.27	214.00	7732.67
T_7	120 kg N ha^{-1} + 30 kg Sulphur ha^{-1}	16.05	30.67	218.67	8483.33
T_8	120 kg N ha^{-1} +45 kg Sulphur ha^{-1}	15.20	29.13	210.67	7419.33
T_9	140 kg N ha^{-1} + 00 kg Sulphur ha^{-1}	14.73	26.77	202.67	7175.33

T_{10}	140 kg N ha^{-1} + 15 kg Sulphur ha^{-1}	14.60	29.40	208.00	7167.33
T_{11}	140 kg N ha^{-1} + 30 kg Sulphur ha^{-1}	16.07	31.07	238.67	9717.33
T_{12}	140 kg N ha^{-1} + 45 kg Sulphur ha^{-1}	15.47	30.13	216.00	7896.67
F- test		NS	NS	S	S
S. Ed. (±)		0.758	2.193	13.656	485.026
C. D. (P = 0.05)		-	-	28.187	1001.094

Grain Yield

An appraisal of table no. 2 reveals that there was significant effect of treatments on grain yield of maize. Maximum grain yield (9717.33 kg ha^{-1}) was recorded in treatment T_{11}followed by treatment T_7 (8483.33 kg ha^{-1}). The increase in grain yield ha^{-1} as a result of increasing nitrogen and sulphur application is attributed to enhanced CGR, NAR and DWP which ultimately increased grain number ear^{-1} and grain weight ear^{-1}.The other reason for increase in grain yield/ha with successive increase in nitrogen and sulphur was due to more leaf area anddry weight $plant^{-1}$. It was also observed that sulphurhad significant influence on grain yield at 30 kg ha^{-1}than 45 kg ha^{-1} as it shows antagonistic effect thus reduced grain yield.These findings corroborate with the results of (Shiraji, *et al.,* 2000) [10] and (Panda, *et al.* 2000).

Conclusion

Based on the above findings it can be concluded that an application of 140kgN ha^{-1}+ 30kg of S ha^{-1} is the best combination of nitrogen and sulphur forobtaining better growth attributes and higher yield of hybrid maize and can be recommended to the farmers of Allahabad region for sustaining productivity and profitability of maize.

Reference

1. Agriculture Statistics at a Glance, Ministry of Agriculture, GOI. Oxfrd Press, 177-199.
2. Alam Mh, Morshed, Islam, Md Nazrul, Md shah, Rahman M, Howue M. Effects of sulphur and nitrogen on the yield and seed Quality of maize(cv. Barnali) online journal of biological sciences. 2003; 3(7):643-654.
3. Jeet S, Singh JP, Kumar R, Prasad RK, Kumar P, Kumari A, Prakash P. Effect of Nitrogen and Sulphur Levels on Yield, Economics andQuality of QPM Hybrids under Dryland Condition of Eastern UttarPradesh, India.Journal of Agricultural Science, 2012; 4(9):1916-9752.
4. Kandil, EEE. Response of some maize hybrids (Zea mays L.) to different levels of nitrogenous fertilization. J. of App. Sci. Res. 2013; 9(3):1902-1908.
5. Pandey AK, Mani VP, Singh RD. Effect of rate of nitrogen and time of application on yield and economics of baby corn (Zea mays L.). Indian J. Ahron. 2000, 43-338.
6. Qahar A, Ahmad B. Macro Nutrients (Nitrogen and Sulfur) Role in Phenology and Physiology of Different Corn Hybrids under Agro Climatic Conditions of Peshawar, Pure Appl. Bio. 2015; 4(1):89-96.
7. Rasheed M, Hussain A, Mahmood T. Growth analysis of hybrid maize as influenced by planting techniques and nutrient management. Intl. J. of Agric. & Bio. 2003; 2:169-171.
8. Rasheed M, Ali H, Mahmood T. Impact of Nitrogen and Sulfur Application on Growth and Yield of Maize (Zea mays L.) Crop. Journal of Research (Science). 2004; 15(2):153-157.
9. Sepat A, Kumar A. Influence of irrigation and nitrogen management on yield and economics of maize (Zea mays L.). Crop Res. (Hisar). 2007; 33(1/3):50-52.
10. Shiraji SM, Talukder MSU, Hossain MA, Niazuddin M, Samad MA. Effect of irrigation regices and nitrogen levels on the performance of maize. Bangladesh Agril. Sci. 2000; 27:271.