International Journal of Agriculture Sciences
ISSN: 0975-3710&E-ISSN: 0975-9107, Volume 10, Issue 6, 2018, pp.-5622-5624.
Available online at http://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

EFFECT OF MAIZE HYBRIDS AT DIFFERENT FERTILITY LEVELS ON MAIZE GROWTH AND YIELDS IN RAJASTHAN

SUMAN CHANDRA SHEKHAR*, NAGAR GOVIND KUMAR AND DASHORA L.N.

Department of Agronomy, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture & Technology, Udaipur, 313 001, Rajasthan
*Corresponding Author: Email-cssuman20@gmail.com, govindnagar1540@gmail.com

Received: March 22, 2018; Revised: March 27, 2018; Accepted: March 28, 2018; Published: March 30, 2018

Abstract- A field experiment was conducted at Udaipur during rainy (*kharif*) season of 2014, to study the "Performance of Maize (*Zea mays* L.) Hybrids at Different Fertility Levels under in Maize Grown Areas of Rajasthan" of the maize–genotypes 'CMH 08-292' recorded significantly highest dry-matter accumulation at various stages and yield attributes. Consequently, highest grain (5753.33 kg ha^{-1}), stover (9001.11 kg ha^{-1}) and biological yields (14754.44 kg ha^{-1}) were recorded with CMH-08-292 followed by PHM-3. Among the fertility levels, SSNM recorded highest plant height (264.62 cm), dry matter accumulation (220.89 g plant^{-1}) at harvest. Application of SSNM significantly increased yield components *viz*. number of cobs plant^{-1} (1.25), cob length (18.14 cm), grains weight cob^{-1} (93.08 g), 1000 grains weight (228.72 g) and shelling per cent (86.31%) consequently grain (5092 kg ha^{-1}), Stover (7886.67 kg ha^{-1}) and biological yield (12978.67 kg ha^{-1}) over RDF and farmer's practice.
Keywords- Growth parameters, Yield attributes and Yield

Citation: Suman Chandra Shekhar, *et al*., (2018) Effect of Maize Hybrids at Different Fertility Levels on Maize Growth and Yields in Rajasthan. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 10, Issue 6, pp.-5622-5624.

Introduction

Maize is the third most important cereal crop after rice and wheat in India. Maize is known as the 'Queen of Cereals'. It is a principal staple food in many countries particularly in the tropics and subtropics. It has greater worldwide significance as human food, animal feed, fodder and source of large number of industrial products. In India, maize is cultivated in diverse environments ranging from temperate hill zone of Himachal Pradesh to the semiarid region of Rajasthan. It is cultivated in India over 8.67 million ha with 22.26 million tonnes production having an average productivity of 2566 kg/ha, contributing nearly 8% in the national food basket [1]. Maize is predominantly cultivated under rainfed condition in *kharif* season at Mewar, Wagad and Hadoti regions of Rajasthan. It is the versatile crop that fits well in the existing cropping systems. Being a source of diversified products obtained from industrial inputs, such as starch, corn oil, glucose etc., the demand of maize crop has been constantly mounting. Maize grain has elevated nutritive value as it contains about 72% starch, 10% protein, 4.8% oil, 5.8% fiber and 3.0% sugar [2].

Materials and Method

The region falls under agro-climatic zone IV A (Sub - Humid Southern Plain and Aravali Hills) of Rajasthan. The experimental soil was Clay - loam having pH 7.6, medium in organic carbon (0.66%) and available N low, medium in available P and K. The experiment was laid out in a randomized block design (RBD) with 15 treatments combinations having 3 fertility levels SSNM (110 kg N + 47 kg P_2O_5 +41 kg K_2O ha^{-1}), RDF (90 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1}) & farmer's practice (1ton FYM + 54 kg N + 20 kg P_2O_5 ha^{-1}). The 5 hybrids used in the experiment were; 'PMH-1', 'PMH-3', 'HQPM 1', 'CMH 08-292' and 'CMH-08-350'. There exists significant opportunity to increase fertilizer efficiency and productivity of maize by adopting Nutrient Expert-based field specific fertilizer recommendations [3]. Keeping all in view, an investigation to evaluate the effect of different fertility levels on maize hybrids were undertaken on clay-loam soil. Total amount of rainfall received during maize crop growth in 2014 was 648 mm and this was well distributed in crop growth period. These observations reveal that maximum and minimum temperatures ranged 27.8° - 35.4°C and 16.6° - 27.0°C, respectively during *kharif,* 2014.

Results and Discussion

Effect of Hybrids

Growth parameters

The maize hybrids differed significantly with respect to growth parameters. The results [Table-2] show that hybrid PMH-3 recorded highest plant height 25 DAS, which was significantly higher over CMH-08-350 and HQPM-1. However, CMH-08-292 attained maximum height (274.87 cm) followed by CMH-08-350 (269.03 cm) at harvest. The results on dry matter [Table-2] show that hybrid CMH-08-292 produced highest dry matter 25, 50, 75 DAS and at harvest. All the hybrids were grown under identical agronomic and external climatic conditions and the marked variation in growth could be ascribed on account of their genetic capabilities to exploit available resources for their growth and development. Since, the differential behaviour of these genotypes in respect to growth parameters could also be explained solely by the variation in their genetic makeup. The results are in close conformity with findings of Kumar [4,5].

Yield attributes and yield

Among the tested hybrids, CMH-08-292 recorded highest cobs plant^{-1} (1.3), cob length (18.55 cm), cob girth (13.43 cm) and grain weight cob^{-1} (98.46 g) [Table-1]. The marked improvement in most of yield attributes with hybrid CMH-08-292 manifested increase in productivity in terms of grain, Stover and biological yields which were recorded 5753.33 kg ha^{-1}, 9001.11 kg ha^{-1} and 14754.44 kg ha^{-1}, respectively. This hybrid was found significantly superior over PMH-3, CMH-08-

350, PMH-1 and HQPM-1in respect to biological yield [Table-3]. The significant increase in yield attributes with hybrid CMH-08-292 over other hybrids seems to be on account of overall improvement in growth as evinced from higher production of dry matter as well as nitrogen, phosphorus and potassium uptake at harvest subscribe to the view that there was greater availability of growth inputs matching with formation and development of yield component. The greater availability of photosynthates as evinced from higher biomass accumulation along with availability of nutrient particularly nitrogen, phosphorus and potassium in hybrid CMH-08-292 might have resulted in enhancing yield attributes. The higher biomass accumulation and improvement in yield attributes seems to improved grain, Stover and biological yield of CMH-08-292. The results of the present investigation are in close accordance with the findings of AICRP on maize [6].

Table-1 *Effect of hybrids and fertility levels on plant height and dry matter accumulation*

Treatments	Plant height (cm)		Dry matter accumulation (g plant^{-1})			
	25 DAS	At harvest	25 DAS	25 DAS	50DAS	75DAS	At harvest
Hybrids						
PMH-1	42.23	262.76	10.91	57.85	180.29	193.22
PMH-3	43.11	262.63	11.26	63.64	182.39	193.82
HQPM-1	40.44	247.22	10.48	59.78	163.00	185.00
CMH-08-350	40.37	269.03	11.77	61.22	176.68	188.67
CMH-08-292	42.11	274.87	12.41	65.83	189.00	210.80
SEm±	0.61	3.53	0.37	1.52	4.92	5.14
CD (P=0.05)	1.76	10.21	1.08	4.41	14.26	14.90
Fertility levels						
SSNM	42.33	264.62	12.68	64.50	197.23	220.89
RDF	41.98	264.12	11.32	61.59	173.95	189.20
FP	40.64	261.16	10.09	58.90	163.64	172.81
SEm±	0.47	2.73	0.29	1.18	3.81	3.98
CD (P=0.05)	1.36	NS	0.84	3.42	11.04	11.54

Table-2 *Effect of hybrids and fertility levels on yield attributes*

Treatment	Cobs plant^{-1}	Rows cob^{-1}	Cob length (cm)	Cob girth (cm)	Grain weight cob^{-1} (g)	1000 grains weight (g)	Shelling (%)
Hybrids							
PMH-1	1.12	13.83	17.61	13.06	85.55	218.66	79.32
PMH-3	1.20	13.89	16.99	13.20	94.21	221.92	83.62
HQPM-1	1.10	14.83	15.89	12.22	83.00	217.76	83.76
CMH-08-350	1.20	13.28	18.47	13.30	87.94	219.91	82.87
CMH-08-292	1.30	14.00	18.55	13.43	98.46	225.17	83.84
SEm±	0.03	0.27	0.26	0.16	2.20	1.36	1.34
CD (P=0.05)	0.08	NS	0.74	NS	6.38	3.95	NS
Fertility levels							
SSNM	1.25	14.23	18.14	13.19	93.08	228.72	86.31
RDF	1.16	13.93	17.69	13.10	90.64	218.63	82.31
FP	1.14	13.73	16.67	12.84	85.78	214.70	79.42
SEm±	0.02	0.21	0.20	0.12	1.71	1.06	1.04
CD (P=0.05)	0.06	NS	0.58	NS	4.94	3.06	3.01

Effect of Fertility Levels

Growth parameters

The concomitant effect of these improvements ultimately led to production of higher biomass by plants at harvest. SSNM also proved better in dry matter accumulation at harvest (220.89 g plant^{-1}) [Table-2]. The overall improvement in crop growth under the influence of optimum nutrition involving combination of all nutrients and increasing fertility levels could be ascribed to their potential role in modifying soil and plant environment conducive for better development of both morphological and biochemical components of the plant growth that increase efficiency of physiological processes of plant system. Amongst nutrients, nitrogen is considered to be a vitally important plant nutrient. N is the integral part of the chlorophyll molecule, which is the primary absorber of light energy needed for photosynthesis. Deficiency of N and chlorophyll means that crop will not efficiently utilize sunlight as an energy source to carry out essential functions such as nutrient uptake. It is a component of vitamins and energy systems in plants. Nitrogen is an essential component of amino acids, which form plant proteins. Besides these, it is also a constituent of certain organic compounds of physiological importance [7]. Phosphorous improves various metabolic and physiological processes and is also known as “energy currency” in plant which is subsequently used for vegetative and reproductive growth through phosphorylation. In addition to this vital metabolic role, P is a structural component of nucleic acid, phytin, phospholipids and enzymes. The extensive root system helps in extracting the maximum nutrients and water from the soil [8]. Potash is not a structural part of any molecule inside the plant but it is necessary for many plant functions, including carbohydrate metabolism, enzyme activation, osmotic regulation and efficient use of water, N uptake and protein synthesis and translocation of assimilates. Besides these, it also improves the diseases resistance in plant, improving quality and reducing the lodging of crop [9]. Thus, better nutritional environment in plants under the influence of increased fertilization seems to have promoted height of plants and growth of individual leaf by way of active cell division, elongation and even improved chlorophyll synthesis. The larger canopy development and plant height under the application of SSNM dose of fertilizer might have increased interception, absorption and utilization of radiant energy, photosynthesis and finally accumulation of dry matter per plant [10].

Yield attributes and yield

It is evident from results [Table-1] that application of site specific nutrient management improved yield attributes *viz*. cobs plant^{-1} (1.25), rows cob^{-1} (14.23), cob length (18.14 cm), cob girth (13.19 cm), grain weight cob^{-1} (93.08 g), consequently grain yield (5092 kg ha^{-1}), stover yield (7886.67 kg ha^{-1}), biological yield (12978.67 kg ha^{-1}) and harvest index (39.23%) [Table-3]. Marked increase in

yield attributes of crop under application of SSNM appears to be on account of vigorous growth in individual plant as reflected by increasing height and total biomass accumulation. N, P, and K fertilization play vital role in different metabolic activities and in improving nutritional status of plant in reproductive parts. These improvements suggest greater availability of metabolites and nutrients synchronized to demand for development of each reproductive structure. Thus, higher availability of all these inputs as evinced from plant height and dry matter accumulation, crop growth rate, relative growth rate, and leaf area index at harvest demonstrate reduced competition of these between developing structure, consequently improving functional activity of each reproductive structure. The highest grain yield realized with combined application of various plant nutrients under SSNM could be ascribed to its profound influence on vegetative and reproductive growth of the crop. The SSNM method with optimum applied-nutrients, especially nitrogen, adequately responded the plant need that led to getting better grain yield than other. SSNM increased the biological yield (12978.67 kg ha^{-1}) when compared with RDF (11896.67 kg ha^{-1}) and farmer's practice (8981.33 kg ha^{-1}). This technology helps to reduce the gap between actual and potential yield [11].

Table-3 *Effect of hybrids and fertility levels on yields and harvest index*

Treatment	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Hybrids				
PMH-1	3911.11	6084.44	9995.56	39.12
PMH-3	5032.22	7881.11	12913.33	38.97
HQPM-1	2951.11	4262.22	7213.33	40.91
CMH-08-350	4573.33	6977.78	11551.11	39.59
CMH-08-292	5753.33	9001.11	14754.44	38.99
SEm±	133.13	187.25	280.94	0.74
CD (P=0.05)	385.66	542.44	813.85	NS
Fertility levels				
SSNM	5092.00	7886.67	12978.67	39.23
RDF	4679.33	7217.33	11896.67	39.33
FP	3561.33	5420.00	8981.33	39.65
SEm±	103.12	145.04	217.62	0.57
CD (P=0.05)	298.73	420.18	630.41	NS

Conclusion

On the basis of the results emanated from present investigation, it can be concluded that maize hybrid CMH-08-292 appears to be better suited as it gave the highest grain yield, net returns and B:C.

Application of research: Application of SSNM appears to be the suitable economic fertility level for maize hybrid.

Research Category: Crop Science

Abbreviations:
SSNM: Site Specific Nutrient Management

Acknowledgement / Funding: Authors are thankful to Maharana Pratap University of Agriculture & Technology, Udaipur, 313 001, Rajasthan. Authors are thankful to the members of Advisory Committee Professor Dr N.S. Solanki, Professor Dr B. Upadhyay, Professor Dr H.S. Purohit, Professor DRI Nominee for providing enthusiastic encouragement, valuable guidance, suggestions for this research. Authors are grateful to Professor Dr R.C. Tiwari, Head, Department of Agronomy for providing necessary facilities during my M.Sc. programme.

*** Major Advisor of Research: Professor Dr L.N. Dashora**
University: Maharana Pratap University of Agriculture & Technology, Udaipur, 313 001, Rajasthan
Research project name or number: Nil

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

References

[1] Govt. of India, (2014) Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India.
[2] Rafiq M.A., Malik M.A. and Hussain M. (2010) *Pakistan Journal of Agricultural Science,* 47, 201-208.
[3] Satyanarayana T., Majumdar K. and Biradar D.P. (2011) *Karnataka Journal of Agricultural Sciences*, 24, 86-90.
[4] Kumar A. (2008) *Indian Journal of Agronomy,* 53, 306-309.
[5] Strigens A.G., Haussmann C. and Melchinger A.E. (2012) *Crop Science,* 52, 1084-1092.
[6] DMR (2014) Directorate of Maize Research, New Delhi, pp-A-114.
[7] Havlin J.L., Beaton J.D., Tisdale S.L. and Nelson W.L. (2006) Soil fertility and fertilizer 7th Edition Prentice Hall of India Pvt. Ltd., New Delhi, pp.45-79.
[8] Tondon H.L.S. (1987*) Fertilizer Development and Constation Organization*, New Delhi.
[9] Kumar A. and Yadav V.K. (2010) *Green Farming,* 1, 165-166.
[10] Mehta S., Bedi S. and Vashist K.K. (2011) *Indian Journal of Agricultural Sciences* 81, 50-54.
[11] Srivastava B.S., Singh D. and Tiwari K.N. (2009) *Better Crop,* 3, 25-27.