CONTEMPORARY RESEARCH IN INDIA
ISSN 2231 - 2137

EVALUATION OF THE INTERACTIVE EFFECTS OF PLANT DENSITY NUTRIENT LEVELS AND GENOTYPES ON THE PRODUCTIVITY OF MAIZE UNDER SUB-MONTANE ZONE

R. M. Gethe[1], B. R. Najan, L. N. Tagad, J. D. Jadhav and R. R. Hasure

All India Coordinated Research Project for dryland Agriculture

Zonal Agriculture Research Station Solapur

Received: 18/08/2017 | **Edited: 22/08/2017** | **Accepted: 28/08/2017**

Abstract: *The field experiment was conducted during kharif 2013-14 at AICRP on Maize Project, Kolhapur to evaluate two plant densities with different crop geometry 50x 20 cm (1,00,000 plant ha^{-1}), 60x 20cm(83,333 plant ha^{-1}) in main plots and two fertilizer levels (200:65:80) and 250:80:100 kg N-P_2O_5- K_2O) in sub plot factor and seven genotypes in sub-sub plot treatments. The two years pooled results data indicated that higher maize grain yield (4124 kgha^{-1}) was recorded in plant spacing 50 x20 cm over the plant spacing (60x 20 cm) with superior growth and yield attributing characters as compared to higher (1,00,000 plants ha^{-1}) and normal plant density (83,333 plant ha^{-1}) under 50x20cm and 60x20cm geometry respectively. The fertility level of 250:80:100 kg N:P_2O_5 :K_2O recorded significantly higher grain yield (4193 kgha^{-1}) and straw yield (5591 kgha^{-1}). The interaction effect between plant spacing nutrient levels and genotypes was found to be non- significant. In terms of economics returns adoption of high plant density 50x20 cm (1,00,000 plant ha^{-1}) with higher plant nutrient levels (250:80: 100 N P_2O_5) and genotypes BIO 9637 recorded highest B:C ratio.*

Key Words: *Plant geometry, Fertility level, Yield & Economics.*

As the area under maize is increasing and being the exhaustive nature of crop required higher nutrient doses warrant to realize higher grain yield, However, the high yielding of maize genotype extract large amount of mineral nutrients from soil. Continuous maize cropping system without adequate and balanced nutrients has resulted in a wide spread problem of multiple deficiencies (Timsina and connor, 2001) on other hand, long term experiments and other studies indicated that crop productivity can be sustained with balanced fertilizer.

Moreover, the response of hybrid maize to plant density and fertilizer requirement varies widely under dryland condition. Optimum crop geometry is one of the important factors for higher production by efficient utilization of under ground resources and also harvesting as much as solar radiation and in turn better photosynthetate formation (Thava prakaash *et al.*, 2005). In view of this an evaluation was under taken to study the interactive effect of plant density, nutrient levels and genotype an productivity of maize under sub-montane zone.

Material and Method

The field experiments were conducted at AICRP on maize project shenda park Kolhapur M.S. during 2013-14 *Kharif* season to evaluate the interactive effects at plant density, nutrient levels and genotypes on the productivity of maize under of maize under sun-montane zone of Kolhapur region. The farm is geographically situated at 74 °14¹ E longitude, 16 °43¹ N. Latitude and at an altitude of 574 m above mean sea level. The average rainfall of the region was 1015.3 mm (in 65 rainy days). The soil of the experimental field was clay to silt Loam in texture, with low available nitrogen (222 kg/ha), low available phosphorus (26 kg/ha) and low available potassium (175 kg/ha).

To achieve desired plant densities of 1,00,000 and 83,333 plant ha to different geometry were evaluates by keeping 50, 60 cm as inter - 40 w spacing and 20 cm uniformly as intra-row spacing in main plot treatment and two nutrients level 200:65:80 and 250:80:100 N: P_20_5-k_20 in subplot treatment and seven genotypes in sub-sub plot

treatments were tested in split plot design with a net plot size of 4.0 X 3.0 m. Uniform cultural operations and plant protection measures were adopted in all treatments. In maize grain yield was recorded and converted to hectare basis. For maize the observations on growth and yield parameters were recorded. The economics returns were compared by calculating cost of cultivation for different plant density and fertility levels treatment and genotypes of maize.

Result and Dicussion

Growth parameters

All the growth parameters *viz.*, final plant population, plant height, Days to 50% silking, Days to maturity and Bareness in maize plant which were influenced by different plant densities, fertility levels and genotypes in maize (Table 1)

Plant population

Significantly higher plant population hectare 1 were observed in high density planting of 1,00,000 plant ha^{-1} under 50 x 20 cm crop geometry followed by 83,333 plan ha^{-1}. There was marginal increases in final plant population with 250:80:100 kg N: P_20_5:k_20 ha^{-1} compared to 200:65:80 kg N: P_20_5:k_20 ha^{-1} fertility levels. The genotype DCK 9155 significantly recorded final population. 68268 ha^{-1} as compares to another genotypes.

Plant height:

Maize grown at closer row spacing of 50 x20 cm (1,00,000 plant ha^{-1}) taller plants (182.40 cm) as compared to wider spacing of 60 x 20 cm (166.59 cm) closer row spacing might have increased due to competition for sunlight which eventually utilized the resources such as water, nutrients, space and light. This trend also explains that as the number of plants increased in given area the competition among the plants for nutrients, uptake and sunlight interruption also increased (Sangakkara et al. 2004). The variety BIO 9637 recorded significantly highest plant higher (188.33cm) but at par with KHK 26, I J 8521. The fertility level 250:80:100 kg N: P_20_5:K_20 ha produced comparatively taller plant.

Days to 50% silking

Days to 50% silking increased with increase in plant densities. Silking was delayed by one day as plant population increased from 83,333to 1,00,000 plant ha^{-}. The high population might have increased the ASI (Anthess and silking interval) compared to other density. High fertility levels of 250:80:100 has delayed the midsilking by two days as compared to lover fertility level of 200:65:80 N: P_20_5:k_20 kg/ha. The result is in agreement with the findings of Alpha et al. (2006) The genotype DCK 9142 and I J 8521 were recorded day to 50% silk upto 51.16 days.

Days to maturity:

The plant spacing 50 x 20 cm recorded days to maturity 90.43 as compared to 60 x20 cm. Days to maturity 90.60 was recorded by 200:65:80 N: P_20_5:k_20 nutrient levels. The genotype BIO 9637 was recorded days to maturity (89.66)

Yield attributes and yields:

The Yield attributes *viz.*, number of cobs per hectare, thousand grain weight, grain and straw yield (Table 2)

Number of cobs per hectare:

Significantly influences by planting density fertilizer levels and genotypes. Maximum cobs were produces at plant density of 1,00,000 plants ha^{-1} compared to 83,333 which might be due to higher plant population. Similarly, maximum cobs per hectare were produced with higher fertility levels of 250:80:100 and 200:65 : 80 kg N: P_20_5:K_20 ha^{-1}. Similar results were also reported by Abuzar et al. (2011). The variety DCK 9135 was recorded maximum cobs per hectare i.e. (52,638)

Thousand grain weight:

Significantly influences by planting density fertilizer, levels and genotypes. Maximum thousand grain weight was recorded at plant density 60 x 20 cm (254.99 gm) as compared to 50 x 20 cm (243 gm) Was probably due to availability of lets photosynthetates for grain development on account of high inter specific competition which resulted in low rate of photosynthesis and high rate of respiration as result of enhanced mutual shading (Zamir etal, 2011)

Maximum thousand grain weight was recorded at fertilizer level 250:80:100 kg N: $P_2 0_5$:$k_2 0$ (254.05 gm) as compared to 200:65:80 kg N: $P_2 0_5$:$k_2 0$ (243 gm) maximum thousand grain weight was recorded genotype Bio 9637 (256 gm) as compared to other genotypes.

Grain yield:

The grain yield presented as an average over two years responded positively to increasing plant density, fertilizer levels and genotypes. The different in grain yields among the plant density, fertilizer levels and genotypes treatments were more associated with total dry matter.

Significantly maximum grain yield (41.24 q ha^{-1}) was recorded at plant density (50x20 cm) as compared to 60 x 20 cm (36.97 q ha^{-1}). Significantly maximum grain yield (41.93 q ha^{-1}) was recorded at fertilizer levels -250:80:100 kg N:$P_2 0_5$:$K_2 0$ as compared to N - 200:65 : 80 kg N**:** $P_2 0_5$-$K_2 0$ fertilizer treatment (36.28 q ha^{-1}). Significantly maximum grain yield (49.92 q ha^{-1}) was recorded at genotype Bio 9637 as compared to other genotype. Higher number of grains cob and 1000 grain weight might contributed to higher grain yield at 50 x 20 cm i.e. 1,00,000 plants ha^{-1}. These results are supported by Emam (2001). Different fertility levels improved the grain yield significantly.

Straw yield:

Significantly maximum Straw yield (49.68 q ha^{-1}) was recorded at plant density 50 x 20 cm as compared to 60 x 20 cm (44.64 q ha^{-1}). Significantly maximum straw yield (50.54 q ha^{-1}) was recorded at fertilizer levels. 250:80:100 kg N- $P_2 0_5$-$K_2 0$ as compared to 200:65 : 80 N: $P_2 0_5$:$K_2 0$ fertilizer treatment (43.78 q ha^{-1}). Significantly maximum straw yield (59.91 q ha^{-1}) was recorded at genotypes Bio 9637 as compared to other genotypes.

References

A buzar, M.R. Sodozai, G.U. Baloch, M.S., Shah, A.A., Javaid, T. and Hussain, N. (2011). Effect of plant population densities on yield of maize. *The J.Anim. plant Sci.* 21 (4): 692-695.

Alpha Y. Kamara, Menkir, A., Kurch. Ibrahim, Lucky, O. Omoigui and Ekeleme, F. (2006). Performance of old and new maize hybrids grown at high plant densities in the tropical Guinea savanna. Commun. *Biometry crop Sc.* 1(1) : 41-48.

Eman, Y. (2001). Sensitivity of grain yield components to plant population density in non-prolific maize (Zea mays L.,) hybrids. *Indian J. Agric. Sci.* 71(6): 367 -370.

Sanagakkara U.R. Bandarayake, P.S.R.D. Gajanayake, J.N. and stamp, P. (2004). plant population and yield of rainfed maize grown in wet and dry seasons of tropics. Maydica. 49: 83- 88.

Thavaparkaash N, Veluyudham, K. and Muthukumar, V.B. (2005). Effect of crop geometry, intercropping systems and integrated nutrient management practices on productivity of baby corn (Zea mays L,.) based intercropping systems. *Res. J. Agric. Biol. Sci.* 1(4): 295-302.

Timsina, J. and connor, D.J. (2001). Productivity and management of rice - wheat cropping system : issues challenges (Review article). *Field crops Res.* 69 : 93-132.

Zamir, M.S.I., Ahmad, A.H., Javveed, H.M.R. and Latif, T. (2011). Growth and behavior of two maize hybrids (Zea mays L,.) topwards different plant spacing. Cerctari Agronomice in Moldova. 14(2) : 33-40.

Table 1: Effect of plant density, geometry, Nutrient levels and genotypes as influenced by growth parameter of maize under sub-montane zone of Kolhapur region (2014-15)

Treatments	plants Population	Plant height (cm)	Days to 50% silking	Days to maturity	Barreness in maize (%)
Plant density					
S_1 - 60 x20 cm (83,333 plant ha^{-1})	54511	166.59	53.53	89.02	21.97
S_2 - 50x20 cm (1,00,000 plant ha^{-1})	54551	182.40	54.67	90.43	15.03
Sem ±	1470	3.22	0.42	0.45	1.58
CD at 5%	NS	9.13	1.32	1.41	4.92
Nutrient levels (kg ha^{-1})					
N1-200:65 : 80 NPK	60900	174.28	55.28	90.60	14.47
N2-250:80:100 NPK	63854	185.71	53.28	89.21	22.54
SEM±	1469.61	3.22	0.42	0.45	1.58
CD at 5%	NS	10.11	1.31	1.41	4.98
Genotypes					
V_1 PMH 2216	65027	175.83	54.33	88.83	28.60
V_2 DCK 9155	68268	162.25	52.00	88.33	18.25
V_3 DCK 9142	60791	160.83	51.16	88.83	14.48
V_4 KHK 26	63054	186.58	57.66	91.83	12.47
V_5 DCK 9135	61527	170.08	52.91	89.58	11.45
V_6 I J 8521	62638	177.58	51.25	87.33	16.82
V_7 BIO 9637	53915	188.33	56.08	89.66	10.02
SEM±	2449	6.02	0.89	0.84	2.97
CD at 5%	7796	17.08	2.25	2.39	8.42

Table 2: Effect of plant density, geometry, Nutrient levels and genotypes as influenced by yield contributing character and yield of maize under sub-montane zone of Kolhapur region (2014-15)

Treatments	No. of cobs /ha	1000 grain weight (gm)	Grain yield (qha^{-1})	Stover yield (qha^{-1})
Plant spacing (cm)				
S 1- 60x 20 cm	45,713	254.99	36.97	44.64
S2 - 50x 20 cm	50661	243.00	41.24	49.68
SEM ±	1644	3.26	0.95	1.25
CD at 5%	4662	9.99	2.96	3.90
Nutrient levels ($kgha^{-1}$)				
N1- 200:65 : 80 NPK	47538	243	36.28	43.78
N2 -250:80:100 NPK	51621	254	41.93	50.54
SEM ±	1644	3.26	0.89	1.08
CD at 5%	5097	9.78	2.53	3.06
Genotypes				
V_1 PMH 2216	44998	241	23.35	29.31
V_2 DCK 9155	52041	230	32.78	39.67
V_3 DCK 9142	45885	253	27.67	33.20
V_4 KHK 26	49026	247	41.91	50.29
V_5 DCK 9135	52638	244	48.63	58.35
V_6 I J 8521	44679	234	49.47	59.39
V_7 BIO 9637	48679	256	49.92	59.91
SEM±	3076	6.11	1.67	2.02
CD at 5%	9597	17.33	4.73	5.78
Interaction				
SEM±	6152	12.30	3.43	4.04
CD at 5%	NS	NS	NS	NS