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EVALUATION OF MAIZE HYBRIDS FOR THEIR MATURITY GROUPS UNDER DIFFERENT SOWING DATES AND THEIR EFFECT ON QUALITY, YIELD AND ECONOMICS

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Abstract

A field experiment was conducted at Regional Research Station, Karnal during 2012 to study the evaluation of maize (*Zea mays* L.) hybrids for their maturity groups under different sowing dates and their effect on quality, yield and economic. The experiment consisting of four dates of sowing (15th June, 25th June, 5th July and 15th July) in main plot and five maize (*Zea mays* L.) hybrids of different maturity groups namely, HQPM-1 (long), HM-4 (medium), HM-5 (long), HM-6 (early) and HM-7 (extra early) in sub plots was replicated thrice in split plot design. The 10 days advance, normal and 10 days delayed sowing from normal sowing date being at par recorded significantly higher cob placement height, number of rows/cob, number of kernels/cob, cob yield with husk (q/ha), cob yield without husk (q/ha), protein content and yield in grains (q/ha) and gross returns, net returns and B: C ratio as compared to delayed sowing by 20 days from normal sowing date. Highest cob placement height was recorded in HM-4 followed by HQPM-1, HM-5, HM-6 and lowest in case of HM-7. HM-5 recorded maximum number of grain rows/cob among all the hybrids. HM-6 and HM-7 being at par recorded significantly higher number of grain rows/cob as compared to HQPM-1 and HM-4, the later two being at par with each other. HM-5 recorded highest number of kernels/cob, cob yield with husk, cob yield without husk, protein yield, gross returns, net returns and B: C ratio followed by HQPM-1, HM-4 and HM-6 and lowest in case of HM-7.

Key words: Maize, Hybrids, Date of sowing, Quality, Yield, Economics.

Introduction

Maize (*Zea mays* L.) is one of the world's leading cereal crops. It is the third most important food grain in India after wheat and rice. In India, during 2017-18 maize was grown over an area of 9.2 million ha with a total production of 19.3 million tonnes. In Haryana, maize was grown on an area of 6,000 ha, with production of 19,000 tonnes and productivity of 3.12 t/ha during the year 2017-18 (DAC & FW, 2017). Maize has been an important cereal crop sowing to its highest production potential and adaptability to wide range of environment hence called as 'Queen of Cereals' (Choudhari and Channappagouda, 2015). It provides food, feed, fodder and serves as a sources of basic raw material for the number of industrial products *viz*., starch, protein, oil, alcoholic beverages, food sweeteners, cosmetics, more recently as bio-fuel etc. No other cereal is being used as many ways as maize. Maize grain has elevated nutritive value as it contains about 72% starch, 10% protein, 4.8% oil, 5.8% fiber and 3% sugar (Rafiq *et al*., 2010). Maize is grown during South West monsoon season (June-September). As the crop is predominantly grown under rain fed conditions, it is subjected to both biotic and a biotic stresses which are largely influenced by distribution and quantity of rainfall. Weather is one of the key components influencing its production and productivity. Climate variability has a direct, often adverse, effect on the quantity and quality of agricultural production. Temperature, rainfall, humidity, sunshine (day length) are important climatic elements that affect crop production (Sowunmi and Kintola, 2010).

Today, the challenge for maize growers is to find the narrow window between planting too early and planting too late. Farmers who plant maize early are concerned

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about high temperature and early plant growth. On the other hand, farmers who plant late are concerned about different maturity hybrids, and how the late planting will affect the final grain yield and grain moisture. It is generally suggested that farmers should plant the crop on more than one planting date in order to safeguard against unpredicted seasons. For optimization of yield, planting at the appropriate time is very critical as delay in planting date can lead to a linear decrease in grain yields (Anapalli *et al*., 2005). Having these in view it was considered to take the experiment to determine the optimum sowing date as well as effect on quality, yield and economic for maize hybrids.

Materials and Methods

The field experiment was conducted during 2012 at Regional Research Station, of Chaudhary Charan Singh Haryana Agricultural University, Karnal, which is situated in semi-arid, sub-tropics at 29°43'N latitude and 76°58'E longitude at an altitude of 245 meters above the mean sea level. The soil of the region was sandy loam in texture, slightly alkaline in reaction, low in organic carbon (0.38%) and available nitrogen (160 kg ha^{-1}), medium in available phosphorus (9.8 kg ha^{-1}) and potassium (172 kg ha^{-1}). Mean weekly values of important weather parameters during the crop season recorded at meteorological observatory located in ICAR-Central Soil Salinity Research Institute (CSSRI), Karnal are depicted in fig. 1. The mean weekly maximum and minimum temperature during the crop season varied from 29.8°C to 41.6°C and 16.5°C to 27.9°C, respectively. The total rainfall was recorded to be 430.3 mm during the crop seasons 2012.

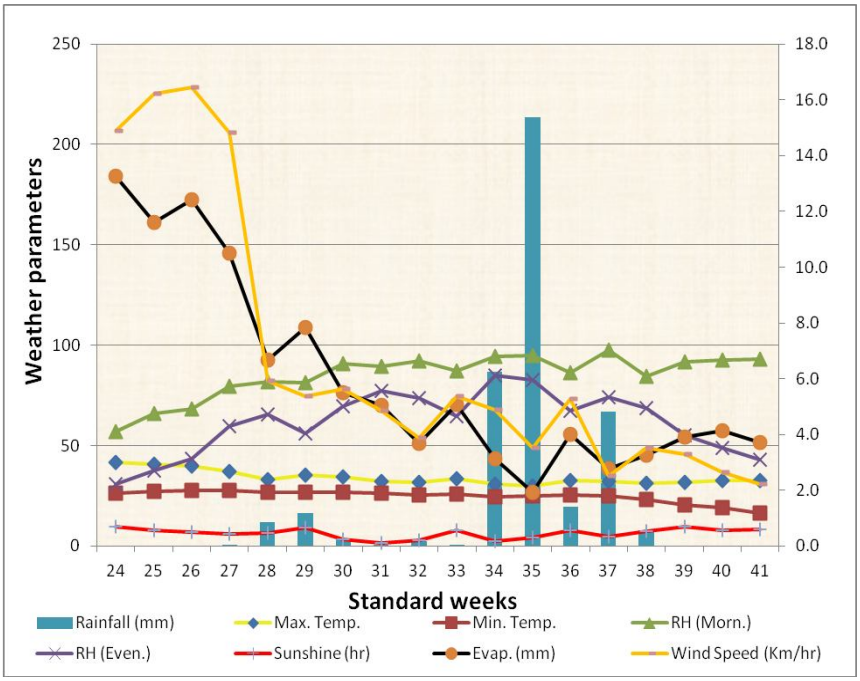

Fig. 1: Mean weekly values of weather parameters during cropping season 2012.

The experiment was laid out in split plot design with four dates of sowing (15th June -10 days before normal date of sowing, 25th June -Normal date of sowing, 5th July -10 days after normal date of sowing and 15th July -20 days after normal date of sowing) and five hybrids of different maturity groups HQPM-1 (Late maturity), HM-5 (Late maturity), HM-4 (Medium maturity), HM-6 (Early maturity), HM-7 (Extra early maturity) in sub plots with three replications.

Maize hybrids as per treatment were sown by manual dibbling method on dry ridge opened at 75 cm with plant to plant spacing of 20 cm with 20 kg ha^{-1} seed rate, sown at a depth of 5-6 cm followed by irrigation up to half of the ridge to ensure proper soil moisture for better germination of seed. Full dose of phosphorus (60 kg ha^{-1}) and potassium (60 kg ha^{-1}) and 1/4th dose of nitrogen (37.5 kg ha^{-1}) through DAP, MOP and Urea, respectively were applied as a basal dose at the time of sowing and remaining 3/4th dose of nitrogen (112.5 kg ha^{-1}) was top dressed through Urea in 3 equal splits *i.e.* at knee high stage, tasseling stage and dough stage. The crop was harvested after full maturity *i.e.* when husk becames dry which is considered to be ideal stage for harvesting. The seed was treated with Thiram 4 g + Imidacloprid 7 g/kg of seed to avoid the attack of fungus and shoot fly. The crop was sprayed with Carbaryl (Sevin) 2 g/liter of water 30 days after sowing (DAS) to control shoot fly with knap sac sprayer. For keeping the weeds under check atrazine 50 WP @ 1.0 kg ha^{-1} was applied as pre emergence followed by manual hand weeding/hoeing at 20 and 45 DAS. All the experimental data were statistically analyzed by the method of analysis of variance (ANOVA). The significance of treatment effects was computed with the help of 'F' (variance ratio) test. All the cultural practices were followed from sowing till harvesting as per the recommended package and practices of CCS Haryana Agricultural University, Hisar.

Results and Discussion

Effect on yield attributes and yield

Advance sowing by 10 days before normal sowing time, sowing at normal time and 10 days delayed from normal date of sowing being at par recorded significantly higher cob placement height as compared to delayed sowing by 20 days from normal time (Table 1). The differences in yield components were mainly due to the growing conditions from tasseling to maturity. First- three

Table 1: Effect of dates of sowing and maize hybrids on cob placement height (cm), number of grain rows/cob, number of kernels/cob.

Treatments	Cob placement height (cm)	Number of grain rows/cob	Number of kernels/cob
Dates of sowing			
15th June	100.0	14.4	438.2
25th June	99.4	14.4	436.3
5th July	98.6	14.2	434.4
15th July	77.0	13.9	384.5
SEm±	1.4	0.06	5.8
CD (p=0.05)	4.7	0.20	20.0
Hybrids			
HQPM-1	95.6	12.8	447.7
HM-4	97.7	12.5	398.5
HM-5	92.4	18.0	497.9
HM-6	92.2	14.2	387.4
HM-7	90.5	13.9	385.2
SEm±	1.5	0.1	4.9
CD(p=0.05)	4.2	0.3	14.1

dates produced higher number of grain rows/cob and number of kernels/cob compared to 4th date of sowing. This was attributed to unfavorable weather conditions at the time of pollination in 4th date of sowing, which resulted in poor seed setting and 1/3rd top portion of the cob remained empty. More over growth in 4th date was not up to the mark leading to poor supply of assimilates to the sink i.e. grain and cob. (Khan *et al*., 2002; Namakka *et al*., 2008; Panahi *et al.,* 2010 and Casini *et al*., 2012). Maximum cob placement height was recorded in HM-4 followed by HQPM-1, HM-5, HM-6 and lowest in case of HM-7. HM-5 recorded significantly highest number of rows/cob among all the hybrids. HM-6 and HM-7 being at par recorded significantly higher number of rows/cob as compared to HQPM-1 and HM-4, the latter two being at par with each other. Among hybrids HM-5 recorded highest number of kernels/cob followed by hybrids HQPM-1, HM-4 and HM-6 and lowest in case of HM-7.

The higher grain yield/plant, cob yield with husk and cob yield without husk were recorded in 10 days advance, normal sowing date and 10 days delayed sowing from normal was attributed to higher values of. number of grain rows/cob, number of kernels/cob. Lowest was recorded in last sowing date (Table 2). Among hybrids, HM-5 recorded significantly highest grain yield/plant. HM-5 produced 17.11, 28.00, 31.50 and 34.06% higher grain yield/plant over hybrids HQPM-1, HM-4, HM-6 and HM-7, respectively. Among hybrids, HM-5 recorded highest cob yield with and without husk. Hybrids HM-4, HM-6 and HM-7 being at par recorded significantly lower cob yield with and without husk as compared to hybrid HQPM-1. It might be due to due to number of grain rows/cob, number of kernels/cob (Svecnjak *et al*., 2004; Azadbakth *et al.,* 2012 and Fabijanac *et al*., 2006). Highest protein content was recorded in HM-7 followed by HM-4, HM-5, HM-6 and lowest in HQPM-1. In contrast to yield response, the sowing dates showed no significant effect on grain chemical composition *i.e.* protein content. The protein content is dependent on N content in grain. Since N content was unaffected by different dates of sowing (Fabijanac *et al*., 2006). The protein yield is a function of protein content in grains and grain yield. The 10 days advance, normal and 10 days delayed sowing from normal sowing date being at par recorded significantly higher protein yield/ha over 20 days delayed sowings from normal (Tiwana *et al*., 1999). Among hybrids, HM-5 recorded significantly highest protein yield/ha. HQPM-1 recorded significantly higher protein yield/ha as compared to HM-4.

Table 2: Effect of dates of sowing and maize hybrids on grain yield/plant, cob yield with husk and cob yield without husk, protein content in grains and protein yield.

Treatments	Grain yield/ plant(g)	Cob yield with husk (q ha^{-1})	Cob yield without husk (q ha^{-1})	Protein content in grains (%)	Protein yield (q ha^{-1})
Dates of sowing					
15th June	108.3	94.9	86.0	9.45	6.09
25th June	106.3	93.8	85.0	9.46	6.00
5th July	104.0	91.6	83.0	9.47	5.84
15th July	82.1	78.1	70.8	9.49	4.62
SEm±	2.0	2.0	1.8	0.03	0.12
CD(p=0.05)	6.7	6.7	6.1	NS	0.41
Hybrids					
HQPM-1	106.6	92.6	84.0	9.25	5.89
HM-4	92.6	82.3	74.6	9.58	5.26
HM-5	128.6	118.8	107.6	9.47	7.22
HM-6	88.1	77.8	70.5	9.41	4.94
HM-7	84.8	76.6	69.4	9.64	4.87
SEm±	1.8	1.8	1.6	0.06	0.10
CD(p=0.05)	5.1	5.1	4.7	0.18	0.31

Table 3: Effect of dates of sowing and maize hybrids on economics.

Treatments	Total cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Return over variable cost (Rs./ha)	Net return (Rs./ha)	B:C ratio
Dates of sowing					
15th June	54736	82985	44105	28249	2.13
25th June	54720	81810	42930	27089	2.10
5th July	54693	79183	40303	24490	2.04
15th July	54499	63021	24141	8522	1.62
Hybrids					
HQPM-1	54724	81601	42721	26877	2.10
HM-4	54591	71238	32359	16647	1.83
HM-5	54912	96235	57355	41323	2.48
HM-6	54555	68418	29538	13863	1.76
HM-7	54527	66256	27376	11728	1.70

Hybrid HM-5 produced 18.43, 27.15, 31.58 and 32.55% higher protein yield over HQPM-1, HM-4, HM-6 and HM-7, respectively. In contrast, higher yielding hybrids HM-5 and HQPM-1 had significantly lower grain protein content than hybrids HM-7. The difference in protein content in different hybrids was attributed to differences in their genetic makeup (Nagy, 2009).

Total cost of cultivation was almost similar for different dates of sowing. Gross returns, net returns and B:C ratios were similar in first three dates of sowing. There was a sharp reduction in 4th sowing *i.e.* 20 days after normal dates of sowing (Table 3). Total cost of cultivation was almost similar for different hybrids under testing. There was a wide difference in hybrids in terms of gross returns, net returns and B:C ratios. HM-5 recorded highest gross returns (Rs. 96,235 /ha), net returns (Rs. 41,323 /ha) and B:C ratio (2.48) followed by HQPM-1, HM-4, HM-6 and lowest in case of HM-7. Hybrid HM-5 recorded 15.21, 25.98, 28.91 and 31.16% higher gross returns over HQPM-1, HM-4, HM-6 and HM-7, respectively.

Conclusion

It is concluded that optimum dates of sowing of maize in Haryana was June 15 to July 5 as it utilized prevailing weather condition especially temperature for *kharif* season. Among hybrids HM-7 (extra early), HM-6 (early), HM-4 (medium) and HQPM-1 and HM-5 (long duration) can be grown successfully from June 15 to July 5. HM-5 was found best yielder and better economics among all the hybrids under all the dates of sowing.

References

Anapalli, S.S., L. Ma, D.C. Nielsen, M.F. Vigil and L.R. Ahuja (2005). Simulating planting date effects on corn production using RZWQM and CERES-Maize models. *Agronomy Journal.*, **17(97):** 58-71.

Azadbakht, A., G. Azadbakht, H. Nasrollahi and Z. Bitarafan (2012). Evaluation of different planting dates effect on three maize hybrids in koohdasht region of Iran. *International Journal of Science and Advanced Technology.*, **2(3):** 34-38.

Casini, P. (2012). Maize production as affected by sowing date, plant density and row spacing in the Bolivian Amazon. *Journal of Agriculture and Environment for International Development.*, **106(2):** 75-84.

Choudhari, V.V. and B.B. Channappagouda (2015). Effect of organics on morpho-physiological traits and grain yield of maize (*Zea mays* L.). *The Bioscan.*, **10(1):** 339-341.

DAC & FW (2017). Agricultural Statistics at a Glance (2017). Department of Economics and Statistics, Department of Agriculture and Cooperation, Krishi Bhawan, Govt. of India.

Fabijanac, D., B. Varga, Z. Svecnjak and D. Grbesa (2006). Grain yield and quality of semiflint maize hybrids at two sowing dates. *Agriculturae Conspectus Scientificus.*, **71(2):** 45 50.

Khan, N., M. Qasim, F. Ahmed, F. Naz and R. Khan (2002). Effect of sowing dates on yield of maize under agroclimatic condition of Kaghan valley. *Asian Journal of Plant Science.,* **1(2):** 146-147.

Nagy, J. (2009). Effect of sowing date on the yield and quality of maize hybrids with different growing seasons. *Acta Agronomica Hungarica.*, **57(4):** 389-399.

Namakka, A., I.U. Abubakar, I.A. Sadik, A.I. Sharifai and A. Hassas (2008). Effect of sowing date and nitrogen levels on yield andyield components of two extra early maize varieties (*Zeamays* L.). *ARPN Journal of Agricultural and Biological Science.*, **3(2):** 1-5.

Panahi, M., R. Nsaeri and R. Soleimani (2010). Efficiency of some sweet corn hybrids at two sowing dates in central Iran. *Middle- East J. of Scientific Research.*, **6(1):** 51-55.

Rafiq, M.A., M.A. Malik and M. Hussain (2010). Effect of fertilizer levels and plant densities on yield and protein content of maize. *Pakistan Journal Agricultural Science.*, **47:** 201- 208.

Sowunmi, F.A. and J.O.A. Kintola (2010). Effect of climatic variability on maize production in Nigeria. *Research Journal of Environment and Earth Science.*, **2(1):** 19-30.

Svecnjak, Z., B. Varga, A. Pospisil, Z. Jukic and J. Leto (2004). Maize hybrid performance as affected by production systems in Croatia. *Bodenkultur.*, **55:** 37-44.

Tiwana, U.S., M.S. Tiwana., K.P. Puri and I.S. Thind (1999). Forage production potential of maize varieties under different dates of sowing and nitrogen levels. *J. of Research Punjab Agricultural University*, *Ludhina.*, **36(1-2):** 5-8.