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Productivity & Economics of Single Cross Hybrid Maize (*Zea Mays* L.) Under Varying Level of Hydrogel Polymer and Fertility Levels under Rain Fed Conditions

M. Bera[1], D. Chouhan[2], P. Choudhary[3], D. Singh[4] and M. K. Kaushik[5]
Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan-313 001

ABSTRACT

The experiment was conducted under field condition at Instructional Farm, RCA, MPUAT, Udaipur during rainy season of 2019 to ascertain suitable 4 hydrogel level (Control, 2.0, 5.0 and 7.5 kilogram per hactare) & 4 fertility levels (75 kilogram Nitrogen + 40 kilogram Poshporus +30 kilogram Potassium, 90 kilogram Nitrogen + 45 kilogram Phosphorus +35 kilogram Potassium, 105 kilogram Nitrogen + 50 kilogram Posphorus + 40 kilogram Potassium & 120 kilogram Nitrogen + 55 kilogram Posphorus + 45 kilogram Potassium per hactare). Results indicated that highest grain yield and economics was realized under application of 7.5 kilogram hydrogel polymer ha^{-1}, however in terms of Benefit Cost ratio 5.0 kg hydrogel polymer ha^{-1} application proved economically beneficial and best to meet out water stress under rain fed conditions. Providing 105 kg N + 50 kg P_2O_5+40 kg K_2O ha^{-1} affirmed potential role in increasing the productivity of single cross hybrid maize under rain fed conditions.

Keywords: Single cross hybrid, hydrogel polymer and fertility levels.

In Rajasthan maize crop is an important cereal crop & grown on 9.34 lakhs hactare with the production & productivity of 1.76 lakhs tone & 1889 kilogram per hectare (Govt. of Rajasthan 2019). 45 per cent out of the total production is consumed as staple food in various forms. Beside this, for poultry birds maize is a main ration. Maize is used for forage purpose as fresh or dry fodder. The climate of southern Rajasthan is very favorable for cultivation of maize crop. In recent years, the maize production has shown a remarkable increase which is mainly associated with recent development towards generation of single cross hybrids. The single cross hybrids replaced older varieties to the extent of 40 to 60 per cent (Singh *et al.,* 2017). These single cross hybrids are nutrient exhaustive and require very high dose of the nutrients for survival (Om *et al.,* 2014). About 80 per cent of maize is cultivated during the monsoon season, mostly under rain fed conditions. During this period, no similar trend for dry spell has been noted and majority of maize growing areas in the state is exposed to 15 to 20 per cent probability of the

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occurrence of moderate drought which may be at any stage causes severe reduction in grain yield or sometimes crop

[1, 2 & 3] **Ph.D. scholar [4]&[5] Professor, MPUAT, Udaipur Email of corresponding author: dilipagron@gmail.com**

failure situation. For all crops, water is an important life saving natural resource also particular maize. Water influences the photosynthesis, respiration, absorption, translocation & utilization of mineral nutrients & cell division (Kumari, 2017). Thus rain fed situation needs sustainable use of available water in soil by absorption & desorption over the long period of time in soil for the efficient use of available resources by the hybrid maize plants. Soil conditioners like super absorbent polymer (Hydrogel) has a great potential to explore the existing water in soil for agricultural crops by increasing their production (Kumari, 2017).Thus, use of polymers has great importance for their role in increasing maize productivity.

Amongst nutrients, nitrogen, phosphorus and potassium are most important for plant growth and development. The recommendation of nitrogen, phosphorus and potash fertilization for rain fed maize in Southern Rajasthan is 70 kilogram Nitrogen, 30 kilogram Phosphorus and 30 kilogram Potassium ha^{-1} (Suthar *et al.,* 2014). The national recommendation of nitrogen, phosphorus and potassium for single cross maize hybrid is 120 kilogram Nitrogen, 60 kilogram Phosphorus & 40 kilogram Potassium ha^{-1} (Das *et al.,* 2010). Thus, there is a need to revise this fertility level for single cross hybrid.

MATERIALS AND METHODS

The experiment was conducted under field condition at Instructional Farm, RCA, MPUAT, which is situated at 23°34'North latitude & 73°42'East longitude at an altitude of 582.17 m above the mean sea level. The experiment site soil was clay loam having pH 7.5, available N 270.18 kg ha^{-1}, available P_2O_5 18.7 kg ha^{-1} and available K_2O 370.5 kg ha^{-1}. The precipitation of 452 mm was recorded during the period of crop growth with stress of 15 days at maturity period. The treatment, four hydrogel polymer level (Control, 2.0, 5.0 and 7.5 kg / ha) and 4 fertility levels (75 kilogram Nitrogen + 40 kilogram Phosphorus +30 kilogram Potassium, 90 kilogram Nitrogen + 45 kilogram Phosphorus +35 kilogram Potassium, 105 kilogram Nitrogen + 50 kilogram Phosphorus +40 kilogram Potassium and 120 kilogram Nitrogen + 55 kilogram Phosphorus + 45 kilogram Potassium ha^{-1}) were tested in factorial randomized block (RBD) design and replicated thrice. The medium maturing single cross "Pratap Maize Hybrid-3"

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was used as test variety. The crop were sown manually by placing seeds at depth of 5-6 cm maintaining rows & plants spacing at 60 × 25 cm during first week of July 2019. The crop was harvested during second fortnight of October. The plot size of experimental field was 15 m^2. Thinning was carried out at 15 days after sowing to maintain required plant population. Nitrogen as per treatments was top dressed in 3 splits. As per treatment P_2O_5 and K_2O were applied through DAP & MOP as basal application. In order to reduce the weed competition, 0.5 kg atrazine ha^{-1} as pre-emergence application followed by one hoeing and earthing up at 20 DAS was carried out. Net returns, Benefit Cost ratio were evaluated on the basis of prevailing market prices of inputs & produce.

RESULTS AND DISCUSSION

Fertility level

With the application of 105 kilogram Nitrogen + 50 kilogram Phosphorus +40 kilogram Potassium ha^{-1} significantly increased plant height, chlorophyll content over 75 kilogram Nitrogen + 40 kilogram Phosphorus +30 kilogram Potassium and 90 kilogram Nitrogen + 45 kilogram Phosphorus +35 kilogram Potassium ha^{-1}. Increasing rate fertility from 75 kilogram Nitrogen + 40 kilogram Phosphorus +30 kilogram Potassium ha^{-1} to 105 kilogram Nitrogen + 50 kilogram Phosphorus +40 kilogram Potassium ha^{-1} significantly increased grain, stove yield, net returns and B C ratio. Further enhancement in fertility level failed to record significant variation. Application of 105 kilogram Nitrogen + 50 kilogram Phosphorus +40 kilogram Potassium ha^{-1} significantly reduced days to tasseling and silking, however plant population was not able to record the perceptible variation. Their was significant response up to 105 kilogram Nitrogen + 50 kilogram Phosphorus +40 kilogram Potassium ha^{-1} might be on account of enrichment of soil with these three major nutrients Nitrogen, Phosphorus & Potassium to the level of sufficiency which in turn enhanced growth of plant right from early stage (Suthar *et al.* 2013 and Choudhray *et al.* 2013).

Hydrogel polymer

Likewise application of 5.0 kilogram hydrogel polymer per hactare significantly increased plant height, chlorophyll content consequently increased grain, stover yield, net returns & Benefit Cost ratio and over 2.5 kg hydrogel $ha^{-1}$and control. Further increase in hydrogel polymer though increased these parameters, were as it failed to increase the net returns & Benefit Cost ratio. The use of soil conditioners like hydrogel polymer has a vital potential to explore the

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existing water in soil for agricultural crops by enhancing their production. When polymers are incorporated into the soil it is presumed that they retain large quantity of water which is released as required by plants under water stress and thus save and sustain their growth under partial stress condition. The present increase in yield might be on account of these properties of hydrogel polymer (Kumari , 2017).

CONCLUSION

Based on findings of present investigation, it may be concluded that single cross hybrid under rain fed conditions grown with soil application of 5 kg hydrogel polymer and 105 kilogram Nitrogen + 50 kilogram Phosphorus +40 kilogram Potassium ha^{-1} proved economically profitable.

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Table 1. Effect of hydrogel and fertility levels on growth, yield and economics of maize under rain fed conditions

Treatments	Plant population (000, ha^{-1})	Plant height (cm)	Cob length (cm)	Chlorophyll content (%)	Days to 50 % tasseling	Days to 50 % silking	Yield (q ha^{-1})		Economics	
							Grain	Stover	Net returns (` ha^{-1})	B:C ratio
Hydrogel level (kg ha^{-1})										
Control	64.88	222.6	18.20	2.35	44.83	48.83	43.20	64.75	42891	1.95
2.5	64.50	231.7	19.09	2.36	44.83	48.83	48.06	72.06	49221	2.14
5.0	64.49	236.4	19.50	2.40	44.83	48.92	51.51	77.25	52867	2.16
7.5	64.88	238.3	19.61	2.47	44.58	48.58	53.68	80.40	54842	2.13
SEm ±	0.149	1.4	0.099	0.012	0.275	0.303	0.404	0.609	607	0.03
CD (P=0.05%)	NS	4.0	0.285	0.035	NS	NS	1.167	1.758	1752	0.07
Fertility level (kg ha^{-1})										
75+40+30	64.94	226.2	18.14	2.35	44.92	48.75	39.34	58.99	36564	1.63
90+45+35	64.55	231.2	19.10	2.40	45.17	49.08	47.96	71.85	48497	2.07
105+50+40	64.76	234.8	19.46	2.41	45.00	49.08	54.06	81.03	56954	2.36
120+55+45	64.49	236.9	19.69	2.42	44.00	48.25	55.09	82.59	57806	2.33
SEm ±	0.149	1.4	0.099	0.012	0.275	0.303	0.404	0.609	607	0.03
CD (P=0.05%)	NS	4.0	0.285	0.035	0.795	0.875	1.167	1.758	1752	0.07