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Effect of Application of Micronutrients through Polymer Seed Coating on Growth and Yield of Maize Hybrid (RMH-2)

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ABSTRACT: Field experiment was carried out in Randomised Complete Block [RCB] design with three replications and 16 treatments in *Rabi* season at College of Agriculture, Bheemarayanagudi, Yadagir district, Karnataka during 2014-15. Among the treatments, significantly higher plant height at 30, 60 days and at harvest (78.67, 136.33 and 186.00cm respectively), cob length (17.17cm), cob diameter (4.36cm), cob weight (137.67g), number of grains per cob (381.57), grain yield per plant (113.80 g) and grain yield per hectare (57.50 q) were recorded in the treatment with Potassium molybdate + $ZnSO_4$ each @2g per kg of seed. Control recorded significantly lower plant height at 30, 60 days and at harvest (70.00, 115.20 and 173.20 cm respectively), cob length (13.80 cm), cob diameter (3.38 cm), cob weight (119.23 g), number of grains per cob (368.00), grain yield per plant (95.47 g) and grain yield per hectare (52.02q). From this study, it is inferred that coating the seed micronutrients with Potassium molybdate+ $ZnSO_4$ each @2g per kg of seed through polymer is beneficial for achieving better growth and higher yield of hybrid maize.

Key words: Maize hybrid, Micronutrients, Polymer and Seed coating

Maize (*Zea mays* L.) is the third important cereal crop in the world, next to rice and wheat. It is consumed both as food and fodder and is also required by various industries in India. Maize production has increased with the adoption of improved technologies including seed enhancement technique in which seed is coated with precise amounts of active ingredient [s] along with a liquid polymer without obscuring its shape nor increasing seed size and weight. Since the coatings are thin, if needed, multiple coatings of various ingredients can be done effectively [1].

Micronutrients are required in relatively smaller quantities for plant growth. They often act as co-factors in enzyme systems and participate in redox reactions, in addition to several other vital functions and play a key role in biochemical activities in such as protein synthesis, carbohydrate/protein metabolism, photosynthesis, conversion of sugars to starch, auxin metabolism, pollen formation, integrity of biological membranes and resistance to infection by certain pathogens in plants [2]. Micronutrients may be given as soil application, foliar spray or added as seed treatments. Supplying micronutrients as seed coating with polymers is a convenient, effective and economical method It is known to increase germination and vigour which in turn improve root development, crop establishment in early growth stages and seed yield, even when sown in low micronutrient soils [3].Hence, the experiment was conducted to study the effect of seed coating with micronutrients on growth and yield of maize hybrid (RMH-2).

MATERIALS AND METHODS

Field experiment on the effect of seed coating with micronutrients on growth and yield of maize through polymer was conducted in College of Agriculture, Bheemarayanagudi, Yadagir district, Karnataka during *Rabi* season 2014-15 on plot size of 6.2 x 3.0 mtr, approximate net population per replication is 150 plants. The experiment consisted

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of 3 replications with 16 treatments *viz.*,

T_1: Potassium molybdate @ 2 g per kg of seed, T_2: Potassium molybdate @ 4 g per kg of seed, T_3: $ZnSO_4$ @ 2 g per kg of seed, T_4: $ZnSO_4$ @ 4 g per kg of seed, T_5: Boron @ 2 g per kg of seed, T_6: Boron @ 4 g per kg of seed, T_7: T_1+T_3, T_8: T_2+T_4, T_9: T_3+T_5, T_{10}: T_4+T_6,

T_{11}: T_1+T_5, T_{12}: T_2+T_6, T_{13}: $T_1+T_3+T_5$, T_{14}: $T_2+T_4+T_6$, T_{15}: only polymer and T_{16}: absolute control. The polymer, AgroDisco DC Red L-603 from Incotec Pvt, Ahmedabad, Gujarat was applied at the firm's recommended rate of 6 ml per kg of seed. Fresh and untreated seed of pre - release maize hybrid (RMH-2) was obtained from the Department of Genetics and Plant Breeding, College of Agriculture, Bheemarayanagudi. Observations on growth and yield parameters were recorded by adopting standard procedures. The mean data from the experiment were statistically analyzed by Randomized Complete Block [RCB] design as outlined by [4]. Critical Differences were calculated at five per cent probabilitylevel wherever 'F' tests was found significant for the growth and yield parameters under study.

RESULTS AND DISCUSSION

Seed coating with 6ml of polymer shows significant difference on quality parameters like germination (97.75%), speed of germination (16.00), seedling dry weight (169.75), seedling vigour index (3549). The plant height of maize differed significantly at different stages of crop growth *i.e.* at 30, 60 DAS and at harvest with visible influence of polymer and micronutrient seed treatment as shown in Table 2. and Fig 1. Seed coating with Potassium molybdate and $ZnSO_4$ each @ 2 g per kg of seed *[T7]* showed significantly enhanced plant height at 30, 60 DAS and at harvest (78.67, 136.33 and 186.00 cm) respectively, over all the treatments and control (70.00, 115.20 and 173.20cm respectively). The significant increase in plant height might be due to the micronutrients (zinc and molybdenum in potassium molybdite) which enhanced the seedling establishment; possibly due to the improved metabolic activity in the seed. The hydrophilic polymer present in the coating material also might have improved the rate of water uptake by seeds [5] leading to early germination,better seedling establishment, better plant height and balance of nutrient elements. Molybdenum is known to influence inorganic nitrogen supplied in the form of nitrate or ammonium and also helps in its absorption and

Table 1. Effect of seed coating polymer on seed quality parameters of maize

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling dry weight (mg)	Speed of germination	Vigour index
P_1: control	95.00	12.50	16.13	160.50	14.07	2720
P_2: 2 ml per kg of seed	95.50	13.25	17.80	163.50	14.33	2965
P_3: 4 ml per kg of seed	96.25	13.38	18.05	163.50	14.50	3025
P_4: 6 ml per kg of seed+ T7	97.75	14.50	21.80	169.75	16.00	3549
P_5: 8 ml per kg of seed	95.00	13.88	18.95	164.56	14.83	3119
P_6: 10 ml per kg of seed	95.75	13.13	19.23	164.13	14.88	3098
Mean	95.88	13.44	18.66	164.32	14.77	3078
SEm±	0.43	0.33	1.04	1.39	0.29	107
CD (P=0.01)	1.27	0.98	3.08	4.14	0.85	319

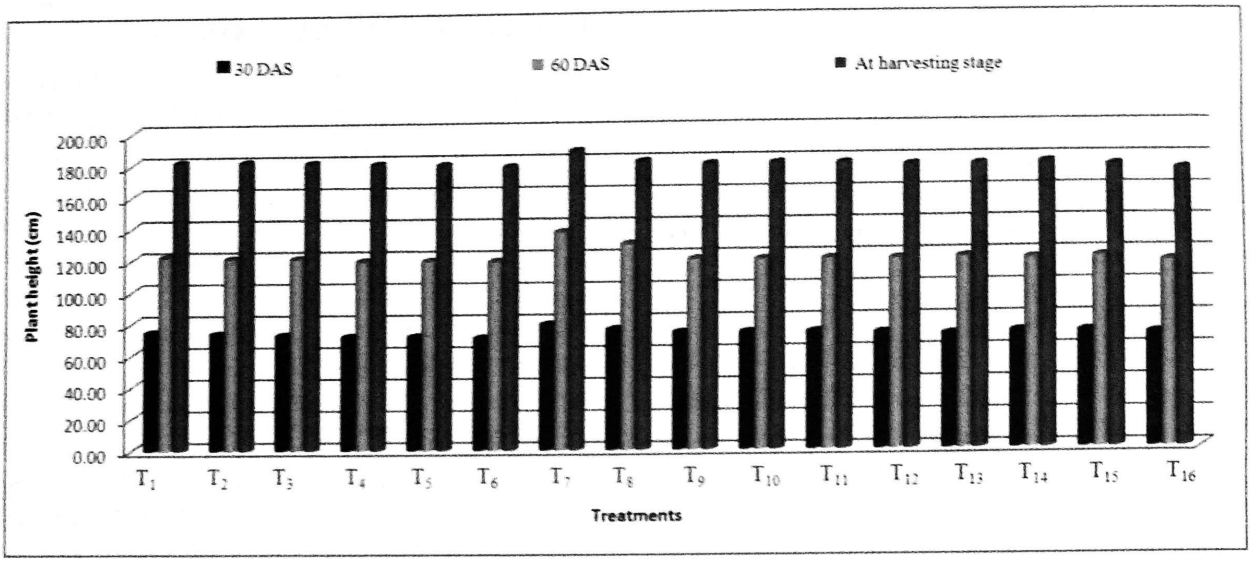

Fig. 1. Effect of polymer seed coating with micronutrients on plant height of maize. Treatment (T) details: $T_1T_2T_3T_4T_5T_6T_7T_8T_9T_{10}T_{11}T_{12}T_{13}T_{14}T_{15}T_{16}T_{17}T_{18}T_{19}T_{20}T_{21}T_{22}T_{23}$. T_1: Potassium molybdate @ 2 g per kg of seed, T_2: Potassium molybdate @ 4 g per kg of seed, T_3: $ZnSO_4$ @ 2 g per kg of seed, T_4: $ZnSO_4$ @ 4 g per kg of seed, T_5: Boron @ 2 g per kg of seed, T_6: Boron @ 4 g per kg of seed, T_7: T_1+T_3, T_8: T_2+T4, T_9: T_3+T_5, T_{10}: T_4+T_6, T_{11}: T_1+T_5, T_{12}: T_2+T_6, T_{13}: $T_1+T_3+T_5$, T_{14}: $T_2+T_4+T_6$, T_{15}: Only polymer, T_{16}: Absolute Control.

Table 2. Effect of seed coating with micronutrients on plant height of maize

Treatment	Plant height (cm)		
	30DAS	60DAS	At harvest
T_1	74.33	121.83	181.40
T_2	73.17	120.67	181.17
T_3	72.23	120.50	180.33
T_4	71.30	118.67	179.33
T_5	71.23	118.67	178.67
T_6	70.33	118.33	177.33
T_7	78.67	136.33	186.00
T_8	75.33	128.67	180.17
T_9	73.17	118.83	178.17
T_{10}	73.00	118.50	178.50
T_{11}	72.83	118.67	178.17
T_{12}	71.83	118.17	176.83
T_{13}	70.67	118.83	176.83
T_{14}	72.00	117.50	177.83
T_{15}	71.67	118.17	175.83
T_{16}	70.00	115.20	173.20
Mean	72.61	120.47	178.80
SEm±	1.10	2.16	1.10
CD 5%	3.19	6.25	3.18

translocation in plant. It provides much of osmotic pull that draws water into plant root system. Zinc helps in activation of phytoenzymes which are involved in physiological process [6]. These findings are in agreement with [7] in maize; and the earlier investigations of [8] and [9] in maize.

Seed coating with micronutrients significantly influenced the yield parameters. Among the treatments, Potassium molybdate+ $ZnSO_4$ each @2 g per kg of seed i.e., T7, recorded significantly higher cob length (17.17 cm), cob diameter (4.36 cm), cob weight (137.67 g), number of grains per cob (381.57), grain yield per plant (113.80 g) and grain yield per hectare (57.50 q).Control treatment recorded significantly lower cob length (13.80 cm), cob diameter (3.38 cm), cob weight (119.23 g), number of grains per cob (368.00), grain yield per plant (95.47 g) and grain yield per hectare (52.02 q). These results are also in conformity with [8] and [9] in maize.

Increase in yield attributing factors due to micronutrients might be due to accumulation of photo-assimilates and partitioning in different parts of the plant. Yield is strongly influenced by micronutrients through their effect on various

Table 3. Effect of seed coating with micronutrients on grain yield and yield parameters of maize

Treatments	Cob length (cm)	Cob diameter (cm)	Cob weight (g)	No of grains/cob	Grain yield/ plant (g)	Grain yield/ ha (q)
T_1	14.87	4.08	125.67	375.50	104.17	54.07
T_2	14.57	3.92	123.33	374.17	103.23	54.00
T_3	14.07	3.74	120.27	373.37	101.17	53.95
T_4	13.97	3.63	117.97	372.00	100.83	53.23
T_5	13.73	3.54	117.13	371.33	98.83	53.53
T_6	13.77	3.50	119.30	369.33	97.50	53.34
T_7	17.17	4.36	137.67	381.57	113.80	57.50
T_8	15.03	4.12	128.21	376.33	106.67	54.12
T_9	14.28	3.75	121.67	370.00	99.40	53.75
T_{10}	14.30	3.66	121.00	369.33	98.27	53.25
T_{11}	14.00	3.72	122.00	371.00	99.00	53.25
T_{12}	13.90	3.63	121.33	369.67	98.17	53.22
T_{13}	14.07	3.72	122.67	369.67	97.17	53.08
T_{14}	14.13	3.66	122.33	369.00	96.50	53.15
T_{15}	13.93	3.54	120.17	368.67	96.00	52.62
T_{16}	13.80	3.38	119.23	368.00	95.47	52.02
Mean	14.35	3.75	122.50	371.81	100.39	53.63
SEm±	0.66	0.11	2.72	1.26	1.28	1.03
CD 5%	1.92	0.32	7.85	3.63	3.69	2.98

Treatment (T): T_1: Potassium molybdate @ 2 g per kg of seed; T_2: Potassium molybdate @ 4 g per kg of seed; T_3: $ZnSO_4$ @ 2 g per kg of seed; T_4: $ZnSO_4$ @ 4 g per kg of seed; T_5: Boron @ 2 g per kg of seed; T_6: Boron @ 4 g per kg of seed; T_7: T_1+T_3; T_8: T_2+T_4; T_9: T_3+T_5; T_{10}: T_4+T_6 ; T_{11}:T_1+T_5; T_{12}: T_2+T_6; T_{13}: $T_1+T_3+T_5$; T_{14}: $T_2+T_4+T_6$; T_{15}: Only polymer; T_{16}: Absolute Control

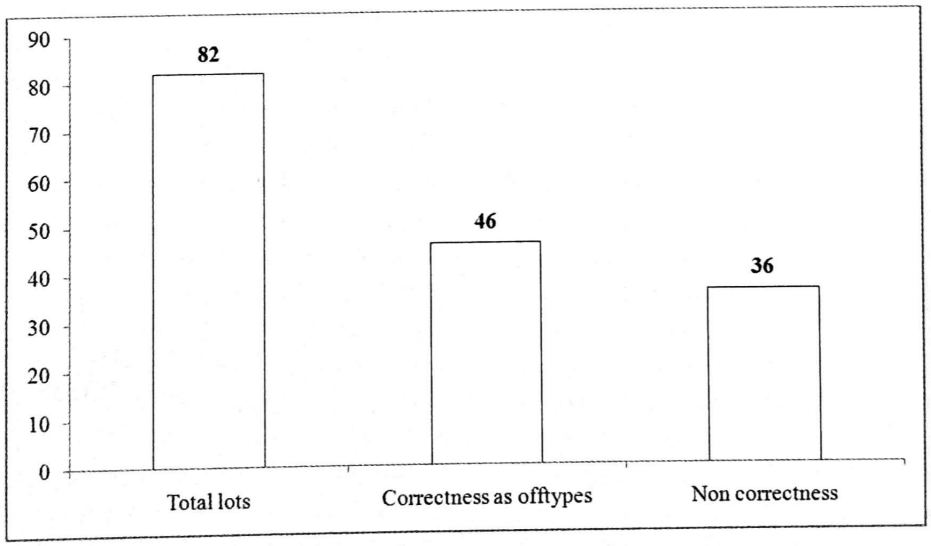

Fig. 2. Seed coating with micronutrients through polymer on grain yield (q/ha) of maize. Treatment (T) details: T_1 T_2 T_3 T_4 T_5 T_6 T_7 T_8 T_9 T_{10} T_{11} T_{12} T_{13} T_{14} T_{15} T_{16} T_{17} T_{18} T_{19} T_{20} T_{21} T_{22} T_{23} T_1: Potassium molybdate @ 2 g per kg of seed, T_2: Potassium molybdate @ 4 g per kg of seed, T_3: $ZnSO_4$ @ 2 g per kg of seed, T_4: $ZnSO_4$ @ 4 g per kg of seed, T_5: Boron @ 2 g per kg of seed, T_6: Boron @ 4 g per kg of seed, T_7: T_1+T_3, T_8: T_2+T4, T_9: T_3+T_5, T_{10}: T_4+T_6, T_{11}: T_1+T_5, T_{12}: T_2+T_6, T_{13}: $T_1+T_3+T_5$, T_{14}: $T_2+T_4+T_6$, T_{15}: Only polymer, T_{16}: Absolute Control.

morpho-physiological traits [10]. Hence, the inference from the study is seed coating with potassium molybdate+ $ZnSO_4$ (each @2 g per kg of seed) applied through polymer can increase the plant growth and final yield of maize hybrid (RMH-2).

REFERENCES

1. ALLOWAY BJ (2008) *Zinc in soils and crop nutrition*. Second edition. Brussels, Belgium: IZA and Paris, France: IFA, Pp: 1352. Baxter L and Waters J L (1986) Effect of a hydrophilic polymer seed coating on the imbibition, respiration, and germination of sweet corn at four metric potentials. *J. American Soc. Hortic.*, **111**: 31-34

3. BISHNU HA, S JIBAN AND RB BANDHU (2010) Effects of micronutrients on growth and productivity of maize in acidic soil. *Intl. Res. J. Appl. Basic Sci.*, **1**: 8-15

4. DILIPKUMAR D (2009) Introductory soil science. *Kalyani publishers*. New Delhi, 284-319

5. HWANG WD AND FJM SUNG (1991) Prevention of soaking injury in edible soybean seeds by ethyl cellulose coating. *Seed Sci. and Technol.*, **19**: 269-278

6. Mc GOWAN AA AND WA WILLIAMS (1971) Seed treatments to delay barley emergence. *Agron. J.*, **63**: 633-635

7. SAEED GHAZVINEH AND MOHAMMAD YOUSEFI (2012) Study the effect of micronutrient application on yield and yield components of maize. *American-Eurasian J. Agric. and Environ. Sci.*, **12**: 144-147

8. SHERIN SJ, A BHARATHI, P NATESAN AND K RAJA (2005) Seed film coating technology for maximizing the growth and productivity of Maize. *Karnataka J. Agric. Sci.*, **18**: 349-356

9. SUNDARARAJAN N, S NAGARAJU, S VENKATARAMANA AND MH JAGANATHA (1972) Design and analysis of field experiments. Univ. Agric. Sci. Bangalore, 148-155

10. VINOD KUMAR, BS VYAKARNAHAL, DP YEGAPPA AND AM ASHA (2013) Effect of seed polymer coating on field performance and quality of pigeonpea [*Cajanus cajan* (L.)] Millsp. *Environ. Ecol.*, **3**: 43-46.