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Effect of Seed Enhancement Treatments and Growth Regulators on Plant Growth and Seed Yield of Maize Hybrid Hema (NAH-1137)

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ABSTRACT

The experiment was conducted to study the effect of seed enhancement treatments and growth regulators on plant growth and seed yield of maize hybrid Hema(NAH-1137)at ZARS, V.C.Farm Mandya during kharif 2013. The different seed enhancement treatment includes T_1: No treatment (control), T_2: Hydration and dehydration T_3: Seed treatment with Vermi wash (75%) T_4: Seed treatment with Spent wash (20%) T_5; Seed fortification with Zinc sulphate (2%) T_6; Seed fortification with Silicilic acid (4%) and growth regulators includes G_1: No spray (control) G_2: Triacontanol (10ppm) G_3: Mepiquat chloride (200ppm) G_4; Silicilic acid (4ml/lt). The result revealed that seed enhancement treatment $ZnSo_4$ (2 %) recorded highest plant height (154.97 cm), number of leaves (15.50) at 90 DAS and chlorophyll content of leaves (22.53) at harvest, cob length (17.53 cm), cob weight (184.10 g), seed yield (2680 kg ha^{-1}), followed by seed treatment with spent wash (20 %). Among the different growth regulators tried, highest plant height (156.49 cm) and number of leaves (15.32) at 90 DAS was observed with 10ppm Triacontanol. Spraying thecrop with 200ppm Mepiquat chloride at 30 and 45 DAS recorded highest chlorophyll content of leaves (22.58) at harvest, cob length (17.33 cm), cob weight (183.79 g), seed yield (2689 kg ha^{-1}) which was on par with Triacontanol at 10ppm. Hence it can be concluded that by treating the seed with 2 per cent Zinc sulphate and spraying of Mephiquate chloride is better plant growth and seed yield can be obtained.

Key words: *Kharif, Vermi wash, Triacontanol, Mepiquat chloride*

INTRODUCTION

The importance of maize is continuously growing and this trend is being recognized by locally and internationally. In fact other than its food and feed uses, corn is now renewable source of energy which is used as raw material for ethanol production. With this economic development corn is no longer just a commodity it is commerce. Because of its immense potentiality for adoption, high yield and nutritive value, it is known as 'King of crops' and 'Queen of cereals'.

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The seed production potentiality of the single cross hybrid Hema (NAH-1137) is comparatively less due to poor performance of parental lines. Senescence will accurse at early stage it leads to stunted growth resulting in poor seed filling, it leads to less seed yield. Hence an experiment was conducted to study the effect of seed enhancement treatments and growth regulators on plant growth and seed yield of maize hybrid Hema (NAH-1137).

MATERIAL AND METHODS

The fresh seeds of Hema parental lines (NAI-137 and MAI-105) collected from ACRIP Maize, ZARS, Mandya and subjected for different seed enhancement treatments *viz.* **T_1:** No treatment (control), **T_2**: Hydration and dehydration **T_3**: Seed treatment with Vermi wash (75%) **T_4:** Seed treatment with Spent wash (20%) **T_5**; Seed fortification with Zinc sulphate (2%) **T_6**; Seed fortification with Silicilic acid (4%). These treated seeds were used to conduct the field experiment at ZARS, V.C.farm, Mandya, during *kharif* 2013. Later the crop was sprayed with growth regulatorsi, e**G_1**: No spray**G_2**: Triacontanol (10ppm)**G_3**: Mepiquat chloride (200ppm)**G_4;** Silicilic acid (4ml/lt) at 30 & 45 DAS.

The recommended quantity of N, P_2O_5 and K_2O in the form of urea, single super phosphate and muriate of potash, respectively were supplied at the time of sowing. The planting ratio 6:2 female and male was followed at the spacing of 60x30 cm. Five plants per plot were selected randomly in the net plot area and tagged for recording growth and seed yield parameters.

RESULTS AND DISCUSSION

Seed enhancement treatment is an effective method to get uniform, speed and highly vigorous seedling in field apart from good quality. In the present investigation the results revealed that the seed enhancement treatments has significant effect on plant growth parameters. The highest plant height (154.97 cm), number of leaves (15.50)at 90 DAS and chlorophyll content of leaves (22.53) at harvest was observed in seeds treated with 2 per cent Zinc sulphate (T_4) followed by seeds treated with 20 per cent spent wash (T_3). All the growth parameters (plant height, number of leaves etc.,) were more due to seed enhancement treatments in hybrid seed production of maize. It may be due to seed enhancement treatments ensured the proper hydration, which resulted in enhanced activity of α-amylase that hydroloysed the macro starch molecules into smaller and simple sugars. The availability of instant food to the germinating seeds gave a vigorous start. Due to more the α-amylase activity higher will be the metabolic activity in seeds, which indicates the higher vigor of the seed. The findings of these studies revealed that seed enhancement treatments enhanced the energy of emergence, and vigour of seedling. Good start is always effect on the final yield of crops. The results are confirmation with works by Muhammad Farooq *et al.*[9], Svilen Raykov *et al.*[15], Chinnuswamy *et al.*[2] and Nazia and Laxmikant[10] confirmed these results.

With respect to yield parameters, highest cob length (17.53 cm), cob weigh (184.1 g), number of seeds per cob (417.21), seed yield per hectare (2680.77kg/ha) was obtained in seeds treated with 2 per cent Zinc sulphate (T_4), followed by seeds treated with 20 per cent spent wash (T_3),while the lowest were recorded in control. The increased yield parameters might be due to the higher physicochemical triggering the biosynthesis of nucleic acids, proteins and the consequential enhancement of cell division besides the enhanced metabolic activity of the plants

resulting on the increased uptake of nutrients by better root system. This could have possibly accounted for improvement in crop performance and it is also due to increased final field stand, better establishment and increased growth parameters like plant height, which lead to more photosynthetic activity which in turn leads more source to sink ratio. These results also confirmed with the findings of Harris *et.al.*[5], Giovacchino *et al.*[4], Shafinazir *et al*[12].

Among the growth regulators highest plant height (156.49 cm),more number of leaves (15.32)at 90 DAS was observedin the crop sprayed with 10ppm Triacontanol (G_1) followed by 200ppm Mephiquate chloride (G_2). (Table 1). It might may due to Triacontinol promotes vegetative growth by active cell division, cell enlargement, cell elongation and thus helped in improving growth characteristics[1], Kumaravelu[7], Naeem[11]. Reduced plant height by Mephiquate chloride might be attributed to the inhibition of synthesis of Gibberellin by this reduced cell division and cell enlargement which in turn reduced the growth attributes, also it reduces the internode distance thereby reducing plant height[8].

Growth regulators may be attributed to decreased chlorophyll degradation and increased chlorophyll biosynthesis. Spraying of growth retardants delays senescence of leaf by arresting the chlorophyll degradation and protease activity and promoting the synthesis of soluble protein andphotosynthetic enzymes. These results are corobated with Channakeshava[1], Muthukumar[8] in Maize, Xinping (2003) in rice. This may be the reason to get significantly higher SPAD chlorophyll meter reading (22.58) of leaves (Table 1) at harvest in 200ppm Mepiquat chloride sprayed plots, followed by 10ppm Triacontanol (G_1). The total chlorophyll content determines the photosynthetic capacity and also stimulating reproductive growth[11,13].

Spraying of 200ppm Mephiquate chloride (G_2) noticed significantly highest cob length (17.33 cm), cob weight (183.79 g) , number of seeds per cob (412.44),and seed yield per hectare (2689.93 kg/ha). Increase in yield parameters due to Mephiquate chloride spray might be due to effective translocation of photosynthates from source to sink. Minimized transpiration losses and increases chlorophyll content which leads better photosynthesis of the plants to supply photosynthates for its larger sink, through increase in hydrolyzing and oxidizing enzyme activities and thereby increased the yield attributes of the treated plants[8]. These foundings are also on agree with work by Channakeshava[1] in maize, Jayachandran *et al*.[6] in rice. One of the strongest roles of Triacontanol affects different plants is that it stimulates the growth of the plant by decreasing carbon dioxide ($C0_2$) inhibition, which in turn increases CO_2 assimilation and enhances photosynthesis[3]. This process helps create plants that are able to acquire more nutrients from their environment, which leads to larger faster growing plants and larger higher quality crop yields[14].

From this experiment we may conclude that among seed enhancement treatments, seed treated with 2 per cent $ZnSO_4$, followed by 20 per cent spent wash and spraying of crop with 200ppm Mepiquat chloride and 10ppm Triacontanol gave higher plant growth and seed yield when compared to control.

Table 1: Influence of seed enhancement treatments and growth regulators on growth and yield parameters in maize hybrid-Hema

Treatments	Plant height@ 90 DAS (cm)	No of leaves) @ 90 DAS	Chlorophyll (SPAD meter reading) @ 90 DAS	No of green leaves at harvest	Cob length (cm)	Cob weight(g)	No of seeds per cob	Seed yield (kg/ha)
Seed enhancement treatments (T)								
T_0:Control	147.98	14.37	19.36	2.33	15.90	161.37	15.90	2451.67
T_1: Hydration and Dehydration	150.58	14.43	20.16	2.52	16.56	166.38	16.56	2589.57
T_2: Seed treatment with Vermi wash (75%)	151.55	14.88	20.48	3.07	16.96	170.50	16.96	2617.92
T_3: Seed treatment with spent wash (20%)	152.45	15.03	21.07	3.13	17.18	181.98	17.18	2658.08
T_4: Seed fortification with Zinc sulphate (2%)	154.97	15.50	22.53	3.49	17.53	184.10	17.53	2680.77
T_5: Seed fortification with Silicilic acid (4%)	150.08	14.74	19.42	3.01	16.56	163.05	16.56	2581.35
S.Em±	**1.32**	**0.15**	**0.85**	**0.15**	**0.30**	**4.82**	**0.30**	**57.40**
CD(P=0.05)	**3.76**	**0.43**	**NS**	**0.42**	**0.87**	**13.73**	**0.87**	**163.40**
Growth regulators(G)								
G_0:Control	145.92	14.29	17.28	2.23	16.24	163.29	16.24	2490.48
G_1:Triacontanol (10ppm)	156.49	15.32	21.99	3.30	17.05	175.83	17.05	2646.36
G_2. Mepiquat chloride (200ppm)	152.44	15.21	22.58	3.76	17.33	183.79	17.33	2689.93
G_3; Silicilic acid (4ml/lt)	148.88	14.49	20.16	2.41	16.79	168.01	16.79	2577.14
S.Em±	**1.08**	**0.12**	**0.69**	**0.12**	**0.25**	**3.94**	**0.25**	**46.87**
CD(P=0.05)	**3.07**	**0.35**	**1.97**	**0.34**	**0.71**	**11.21**	**0.71**	**133.41**
Seed enhancement treatments and Growth regulators (T×G)								
T_0G_0	143.10	13.33	15.77	1.17	12.67	143.67	12.67	2402.76
T_0G_1	153.93	14.83	18.07	3.43	17.05	174.10	17.05	2453.69
T_0G_2	150.27	14.73	21.90	3.50	16.87	167.70	16.87	2638.87
T_0G_3	144.60	14.57	19.70	1.20	16.80	160.00	16.80	2495.35
T_1G_0	149.33	14.27	16.83	2.17	16.70	145.67	16.70	2407.39
T_1G_1	155.50	15.17	22.40	2.90	16.17	169.77	16.17	2671.28
T_1G_2	153.87	14.47	22.70	3.67	17.10	183.83	17.10	2663.87
T_1G_3	147.60	13.83	21.69	1.33	16.27	166.23	16.27	2615.72
T_2G_0	142.27	14.47	13.93	2.33	17.13	165.80	17.13	2499.98
T_2G_1	155.00	15.43	23.00	3.33	17.13	160.67	17.13	2680.54
T_2G_2	149.67	15.27	19.73	3.57	17.20	185.83	17.20	2689.80
T_2G_3	151.27	14.37	21.23	2.83	16.27	169.70	16.27	2601.37
T_3G_0	145.93	14.50	20.90	2.67	16.90	180.47	16.90	2587.95
T_3G_1	159.00	15.70	23.67	3.63	17.40	189.63	17.40	2678.69
T_3G_2	155.27	15.47	23.94	3.80	17.50	193.77	17.50	2708.32
T_3G_3	148.60	15.07	15.75	3.23	16.93	171.07	16.93	2657.39
T_4G_0	149.27	15.33	19.73	2.70	17.17	169.43	17.17	2650.91
T_4G_1	161.93	15.83	24.03	3.93	17.60	194.50	17.60	2731.46
T_4G_2	153.73	15.53	24.70	4.17	18.17	195.50	18.17	2773.13
T_4G_3	154.93	15.30	21.07	3.17	17.17	176.97	17.17	2567.58
T_5G_0	145.60	13.87	16.50	2.33	16.80	174.70	16.80	2513.87
T_5G_1	156.60	15.03	20.17	3.37	16.77	173.33	16.77	2662.48
T_5G_2	155.87	15.07	19.50	3.67	17.13	176.10	17.13	2623.59
T_5G_3	146.27	13.80	20.50	2.67	17.33	164.07	17.33	2525.45
S.Em±	**2.64**	**0.30**	**1.69**	**0.30**	**0.61**	**9.65**	**0.61**	**114.80**
CD(P=0.05)	**7.82**	**0.86**	**4.82**	**0.84**	**1.74**	**27.47**	**1.74**	**326.79**
CV (%)	**8.03**	**8.52**	**14.31**	**17.48**	**6.26**	**9.68**	**6.26**	**7.64**

Table 1: Influence of seed enhancement treatments and growth regulators on seed quality parameters in maize hybrid-Hema

Treatments	100 seed weight (g)	Germination (%)	Mean seedling length (cm)	Mean seedling dry weight(mg)	SVI-I	SVI-II	EC ($\mu Sppm^{1}$)	TDH activity (A_{480nm})
Seed enhancement treatments (T)								
T_0:Control	26.31	98.00	31.10	80.12	3048	7852	465.90	0.742
T_1: Hydration and Dehydration	26.91	98.43	32.20	82.27	3170	8099	441.54	0.743
T_2: Seed treatment with Vermi wash (75%)	27.67	98.20	32.99	83.96	3239	8246	420.91	0.790
T_3: Seed treatment with spent wash (20%)	27.86	98.56	33.36	84.53	3288	8331	420.24	0.852
T_4: Seed fortification with Zinc sulphate (2%)	28.25	98.71	34.64	85.30	3420	8420	409.82	0.880
T_5: Seed fortification with Silicilic acid (4%)	27.31	98.34	32.49	82.15	3194	8079	427.75	0.836
S.Em±	**0.27**	**0.18**	**0.44**	**1.02**	**42.80**	**103.62**	**7.65**	**0.017**
CD(P=0.05)	**1.03**	**NS**	**1.64**	**3.82**	**160**	**387**	**NS**	**0.063**
Growth regulators(G)								
G_0:Control	26.76	98.15	31.29	80.84	3071	7934	440.98	0.781
G_1:Triacontanol (10ppm)	27.66	98.45	33.44	84.21	3292	8292	430.12	0.822
G_2: Mepiquat chloride (200ppm)	28.00	98.60	34.02	84.74	3354	8357	418.84	0.835
G_3; Silicilic acid (4ml/lt)	27.11	98.29	32.45	82.44	3188	8103	434.17	0.782
S.Em±	**0.22**	**0.15**	**0.36**	**0.83**	**34.95**	**84.60**	**6.24**	**0.014**
CD(P=0.05)	**0.84**	**NS**	**1.34**	**3.12**	**130**	**316**	**NS**	**0.051**
Seed enhancement treatments and Growth regulators (T×G)								
T_0G_0	24.65	97.25	29.15	78.23	2834	7607	479.75	0.689
T_0G_1	27.06	97.87	31.56	81.25	3089	7952	473.50	0.784
T_0G_2	27.30	98.62	32.02	81.00	3157	7990	434.50	0.712
T_0G_3	26.21	98.25	31.68	80.00	3112	7860	475.87	0.783
T_1G_0	26.22	98.25	29.55	80.18	2903	7877	464.80	0.788
T_1G_1	27.20	98.37	32.95	82.25	3242	8093	430.37	0.682
T_1G_2	27.60	98.62	33.61	84.47	3314	8329	434.00	0.731
T_1G_3	26.62	98.50	32.71	82.20	3221	8096	437.00	0.772
T_2G_0	27.49	97.92	32.28	81.25	3160	7956	424.00	0.736
T_2G_1	27.91	98.25	33.43	85.70	3284	8419	428.00	0.865
T_2G_2	28.00	98.25	33.80	85.91	3320	8442	427.30	0.877
T_2G_3	27.28	98.37	32.47	83.00	3191	8166	424.37	0.681
T_3G_0	27.58	98.50	32.12	81.75	3163	8052	422.85	0.830
T_3G_1	28.07	98.75	34.14	85.95	3372	8468	417.80	0.871
T_3G_2	28.08	98.75	34.44	86.00	3400	8491	412.75	0.911
T_3G_3	27.74	98.25	32.74	84.64	3216	8314	427.57	0.795
T_4G_0	27.52	98.37	32.39	82.10	3186	8075	420.27	0.853
T_4G_1	28.20	99.00	35.90	88.25	3553	8736	402.02	0.905
T_4G_2	29.50	99.25	37.54	88.43	3725	8776	402.00	0.925
T_4G_3	27.77	98.25	32.74	82.41	3215	8096	425.00	0.839
T_5G_0	27.13	98.62	32.25	81.51	3180	8039	434.25	0.789
T_5G_1	27.50	98.50	32.65	82.05	3216	8082	429.02	0.864
T_5G_2	27.55	98.12	32.69	82.64	3207	8111	422.50	0.862
T_5G_3	27.07	98.12	32.36	82.41	3175	8086	425.25	0.822
S.Em±	**0.55**	**0.37**	**0.88**	**2.04**	**85.60**	**207.23**	**15.30**	**0.034**
CD(P=0.05)	**2.07**	**NS**	**3.27**	**7.63**	**320**	**775**	**NS**	**0.125**
CV (%)	**4.05**	**0.76**	**4.34**	**4.91**	**4.31**	**4.07**	**4.15**	**3.298**

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