Mysore J. Agric. Sci., 51 (1) : 108-112, 2017

Effect of Seed Film Coating Polymers on Growth and Yield of Maize Hybrid Hema

B. Sumalata, Parashivamurthy and R. Siddaraju
AICRP on Seed Technology, NSP, UAS, GKVK, Bengaluru- 560 065

Abstract

A field experiment was conducted during *kharif* 2015 at the National Seed Project, UAS, GKVK Bengaluru to study the effect of seed film coating polymers on field performance and yield in maize hybrid Hema. The experiment was laid under RCBD with four replications**.** Significant enhancement in growth and yield attributes was observed among various treatments as compared to control. The results revealed that, seeds film coated with Polymer (DISCO AG SP RED L-200) + Thiram @ 3g/kg +Genius coat GC172 was found to be significantly superior with respect to growth and yield parameters *viz.*, field emergence (88.75%), speed of germination (0.88), plant height@ harvest(210.2cm), internode length (102.85cm), cob length (22cm), girth of cob (17.33cm), cob weight (312.55g), number of seeds / cob (663), seed yield / plant (229.40g) and seed yield per hectare (81.81q) as compared to untreated control (80.50%, 201.6cm, 96.55cm, 21.21cm, 16.87cm, 293.30g, 646, 213.90g and 75.36q, respectively). Seed coating with polymer in combination with fungicides may be a potent tool for effective disease management against seed and soil-borne pathogens.

Maize (*Zea mays* L.) is one of the most important cereal crop of the world. It has worldwide significance as human food, animal feed and as a raw material for large number of industrial products. Zein is a class of prolamine protein found in maize. Maize is a high yielding, easy to process, readily digestible and cheaper than other cereals used as a basic raw material for the production of starch, oil, protein, alcoholic beverages and food sweeteners and more recently as biofuel. It is a versatile, miracle crop and thus termed as Queen of Cereals. It is sown in total area of 146 million hectares of maize grown globally and approximately 102 million hectares covered in developing world (Anon., 2014a). In India during 2013-14, maize was grown in an area of 7.27 m ha with a production of 15.86 mt with productivity of 2181 kg ha^{-1}. In India Karnataka, Rajasthan, Uttar Pradesh, Madhya Pradesh, Bihar, Andhra Pradesh, Gujarat and Maharashtra are the major maize growing states. (Anon. 2014b). In Karnataka, maize occupies an area of 11.49 lakh ha. with a production of 29.52 lakh t. The average yield is 2705 kg ha^{-1} which is higher than average yield of country. It is grown throughout the year under *kharif, rabi* and summer season.

Maize area is increasing over the years because of potential market and less risk involved in recent years. Despite the high yielding potential and various advantages of maize, the yield per unit area of the crop is low in India. Delay in germination and low seed viability is among the serious problems limiting the production of maize. Highly vigorous seeds germinate rapidly, uniformly and are able to withstand environmental adversity after sowing. However, the use of maize seeds of low physiological quality is a common practice under tropical and subtropical production conditions, leading to inadequate plant population in the field.

Seed coating technology has developed rapidly during the past two decades and provides an economical approach to seed enhancement. An advantage of seed coating is that the seed enhancement material (fungicide and insecticide) is placed directly on the seed without obscuring the seed shape. Seed coatings with natural or synthetic polymers have gained rapid acceptance by the seed industry as a much safer coating material. Tekrony (2006) reported that by polymer coating the improvement in seed weight ranges from 1-10 per cent only since it is of an extremely thin coating and allows multiple layers on the seed. It is one of the most important developments that help in rapid and uniform germination, emergence of seeds and increase seed tolerance to adverse environmental conditions. Seed coating has presented promising and even surprising results, for many seeds including cereal seeds (Bradford, 1986).

Polymer is a chemical compound that is made of small molecules that are arranged in a simple repeating structure to form a larger molecule. The polymer coating with the negligible thickness of 84 micron over the seed coat provides protection from the imposed accelerated ageing, which include fungal invasion. The polymer coating is simple to apply, diffuses rapidly and non- toxic to the seed during germination. It reduces chemical wastage, helps to make room for including all required ingredients, protect the nutrients, oxygen suppliers and protect seed from fungal invasion and insects attack. By encasing the seed with thin film of biodegradable polymer, the adherence of seed treatment to the seed is improves, ensures dust free handling, making treated seed both useful and environment friendly. Hence, the present study was undertaken to study the effect of the polymer treatments on the growth and yield of maize hybrid Hema.

Material and Methods

The field experiment was conducted during *kharif,* 2015 at National Seed Project, University of Agricultural Sciences, GKVK, Bengaluru, which is situated at 12^0 15^1 North Latitude and 77^o 35^1 East longitude and at an altitude of 930 meters above mean sea level. Freshly harvested maize hybrid Hema seeds were procured and sent to INCOTEC Pvt. Ltd. for polymer treatment. The experiment consisted of five treatments and was laid under RCBD with four replications. The treatments included untreated control (T_1)**,** Polymer (DISCO AG SP RED L-200) + Thiram @ 3g / kg + Carboxine (T_2), Polymer (DISCO AG SP RED L-200) + Thiram @ 3g / kg +Genius coat GC172 (T_3), Polymer (DISCO AG SP RED L-200) + Thiram @ 3g / kg +Quick roots BS154 (T_4) and Water soaking + Thiram @ 3g / kg (T_5). The product genius coat GC 172 used in treatment T_3 is a combination of balanced level of organic and naturally occurring substances. The product tends to activate metabolic processes in the developing embryo of the plant. Similarly, the product quick roots BS154 (T_4) is a biological product prepared with a combination of Trichoderma virens and Bacillus subtilis var. amyloiquefaciens. The product colonized roots in symbiotic relationship, produces enzymes which release soil nutrients. Maize seeds were sown by hand dibbling with spacing of 60 cm between rows and 30cm between plants. Five plants were selected randomly and tagged in each treatment for recording plant growth and yield parameters. The research data was statistically analyzed for interpretation. Cultural operations, application of fertilizer, method of sowing, plant protection, harvesting, threshing and cleaning was carried out as per the package of practice.

Results and Discussion

Effect of seed film coated polymer on growth parameters of maize hybrid Hema : Perceptible differences were observed among the film coated polymer treatments with regard to growth yield and seed quality parameters. The field emergence (%) recorded on 16^{th} day after sowing was found significantly highest in Polymer (DISCO AG SP RED L-200) + Thiram @ 3g / kg + Genius coat T_3 (88.75%) which was statistically on par with Polymer (DISCO AG SP RED L-200) + Thiram @ 3g / kg + Carboxine T_2 (88.50%) and lowest was recorded in control T_1 (80.50%) (Fig.1). Polymer coating enables accurate and even doses of chemicals and reduces the chemical wastage; it also makes room for including all the required ingredients like inoculants, protectants, nutrients, herbicides, oxygen suppliers etc. These results are in conformity with Chandrashekhar (2008) and Chikkanna *et al*. (2000) in Pigeonpea.

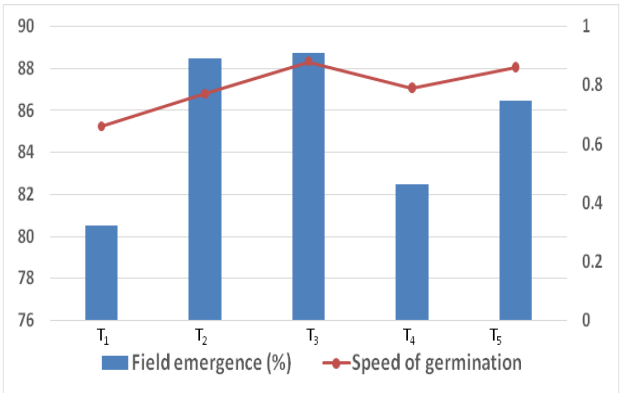

Fig.1. Influence of seed film coating polymer on field emergence (%) and speed of germination in maize hybrid hema

Speed of germination was significantly influenced by seed film coating with polymer. Significantly maximum speed of germination was recorded in seeds coated with Polymer (DISCO AG SP RED L-200) + Thiram + Genius coat (0.88). While, untreated control

(0.66) seeds showed significantly less speed of germination (Fig. 1). The probable reason for rapid germination in polymer coated seeds could be increase in the rate of moisture imbibition where the fine particles in the polymer coating act as a wick or moisture attracting material or perhaps improves the seed surface area (Vanangamudi *et al*., 2003). These results are in agreement with the findings of Sherin and John (2005) in maize with polymer @ 3 g per kg of seed and Imran Baig (2005) in soybean with polymer @ 5 g per kg of seed.

The maximum plant height, at 30 DAS and harvest was recorded in T_3 (44.45cm & 210.2 cm, respectively) which was statistically on par with T_2 (43.86 cm & 209.5 cm, respectively) while, lowest was recorded in control (36.40 cm & 201.6 cm) (Table 1). The treatment T_3 Polymer (DISCO AG SPRED (L-200) + Thiram + Genius coat took least no. of days (62.25) for complete silking and highest no. of days was noticed in control T_1 (64.75). The polymer treatment combinations improve the stress tolerance and crop vitality thus leading to enhanced growth and biomass during the vegetative stages. Similarly, the internode length was recorded highest in T_3 (102.85 cm) closely followed by T_2 (100.25 cm) and T_5 (100.0 cm) and lowest in T_4 (95.85 cm) (Table Ia). The polymer treatment did not had any significant influence on days to 50% flowering, complete flowering and plant stand at maturity. But, however the lowest no. of days for 50 % flowering (53.75), complete flowering (61.75) and highest plant stand at maturity (87.25 %) was recorded in T_3.

Effect of seed film coated polymer on seed yield and yield attributing parameters of maize hybrid Hema : Significant differences were observed among the treatments with respect to girth of the cob, cob weight, no. of seeds / cob, grain yield per plant, grain yield (q / ha) and harvest index (Table II). The girth of the cob (17.33 cm) and cob weight (312.55 g) was recorded highest in T_3 followed by T_2 (17.20 cm and 302.10 g respectively), while lowest was recorded in T_4 (16.59 cm and 281.97 g, respectively). Maximum no. of seeds / cob was noticed in T_3 (663) followed by T_2 (657) and lowest was noticed in control T_1 (646). Similarly, significantly highest grain yield per plant was recorded in T_3 (229.40g) which was statistically on par with T_2 (225.75g) and T_5 (224.65g) and lowest was recorded in control T_1 (213.90g) and T_4 (214.50). Similarly the grain yield per hectare was found highest in T_3 (81.81q) closely followed by T_2 (79.19q) and lowest was recorded in control T_1 (75.36q). The harvest index was found superior in T_3 (0.43) closely followed by T_2 & T_5 (0.40) and lowest was recorded in T_4 (0.38)

TABLE I

Effect of seed film coated polymer on growth parameters of maize hybrid Hema

Treatments	Plant height at 30 DAS (cm)	Plant height at Harvest (cm)	Days to 50 % flowering	Days to flowering	Days to Silking	Inter node length (cm)	Plant stand at maturity (%)
T_1	36.40 ^{b}	201.6 ^{b}	54.50	62.25	64.75 ^{b}	96.55 ^{bc}	81.25
T_2	43.86 ^{a}	209.5 ^{a}	54.00	62.00	64.00 ^{ab}	100.25 ^{ab}	84.50
T_3	44.45 ^{a}	210.2 ^{a}	53.75	61.75	62.25 ^{a}	102.85 ^{a}	87.25
T_4	37.62 ^{b}	204.0 ^{b}	53.75	62.25	64.00 ^{ab}	95.85 ^{c}	82.50
T_5	43.07 ^{a}	206.0 ^{ab}	54.50	61.75	63.25 ^{ab}	100.0 ^{abc}	82.50
SEm±	1.32	1.508	0.531	0.575	0.596	1.409	2.64
CD (P=0.05)	4.07	4.65	NS	NS	1.84	4.34	NS
CV (%)	7.16	6.64	2.19	2.07	2.09	3.18	7.05

NS : Non significant; Means followed by the same alphabet are not significantly different.

TABLE II

Effect of seed film coated polymer on seed yield and yield attributing parameters of maize hybrid Hema

Treatments	Cob lenght (cm)	Girth of Cob (cm)	Cob weight	No of Seeds / cob	100 Seed weight (g)	Grain yield / plant (g)	Grain yield	Harvest Index
T1	21.21	16.87 ab	293.30 b	646 c	33.04	213.90 b	75.36 c	0.37 b
T2	21.76	17.20 ab	302.10 b	657 ab	33.66	225.75 a	79.19 ab	0.40 ab
T3	22.00	17.33 a	312.55 a	663 a	35.20	229.40 a	81.81 a	0.43 a
T4	21.25	16.59 b	281.97 c	649 bc	33.99	214.50 b	77.08 bc	0.38 b
T5	21.25	17.28 a	297.40 b	654 abc	35.26	224.65 a	78.07 bc	0.40 ab
SEm±	0.456	0.211	3.382	2.72	0.645	2.49	0.954	0.014
CD (P=0.05)	NS	0.65	10.42	8.38	NS	7.67	2.94	0.043
CV (%)	4.74	2.77	2.54	4.93	4.22	3.52	3.72	7.84

NS : Non significant; Means followed by the same alphabet are not significantly different.

and control (0.37).There was no significant differences observed for cob length, however T_3 recorded higher cob length (22.00cm). The polymer treatment combinations tend to enhance the metabolic processes in the developing embryo thus increasing the root development and enhancing the plants ability to utilize nutrients. Also the uptake of NPK enhances which ultimately lead to increase in volume of roots.

Seed coating with polymer in combination with fungicides acts as a potent tool for effective disease management against soil-borne pathogens and enables efficient release of chemicals to the root zones thus enhancing the growth and productivity of the crop. Similar results were also obtained by Shushma *et al.* (2014) who reported that the seed coating with polymers increased the yield from 0.93 to 1.62 tonnes per ha in wheat.

Benefit Cost Ratio as influenced by seed film coated polymers on yield of maize hybrid (Hema): The B: C ratio was recorded highest in T_3 (0.54) closely followed by T_2 (0.49) and T_5 (0.48) and lowest was recorded in control (0.43) (Table III). Among the treatments, seed treated with polymer (DISCO AG SP RED (L-200) + Thiram + Genius coat and Polymer (DISCO AG SP RED (L-200) + Thiram + Carboxine were found to be very effective in enhancing the seed

TABLE III

Benefit Cost Ratio as influenced by seed film coated polymers on yield of maize hybrid (Hema)

Treatments	Cost A	Cost B	Cost C	Other (₹)	Total Cost (₹)	Yield (q/ha)	Total returns (₹)	Net returns (₹)	* B : C Ratio
T_1	48,330	7529	6636	500	62,995	75.36	90.432	27.437	0.43
T_2	48,330	7835	6731	500	63,396	79.19	95.028	31.632	0.49
T_3	48,330	8045	6689	500	63,564	81.81	98.172	34.608	0.54
T_4	48,330	7666	6798	500	63,294	77.08	92.496	29.202	0.46
T_5	48,330	7746	6636	500	63,212	78.07	93.684	30.472	0.48

*B: C ratio expressed in net returns per Rupee of expenditure

yield and quality. Also, the hydro-priming along with Thiram treatment @ 3g/Kg proved to be better and cost effective treatment with B: C ratio (0.0.51) for grain yield and quality enhancement.

The present study reiterated the importance of film coated polymers on growth and yield of Maize. The growth, yield and yield attributing characters significantly increased in seed coated with polymer (DISCO AG SP RED (L-200) + Thiram + Genius coat and Polymer (DISCO AG SP RED (L-200) + Thiram + Carboxine and also with hydro-priming. The treatments are found to be cost effective and eco friendly hence can be used for enhancing the growth and yield of crops.

References

ANONYMOUS, 2014a, The Hindu Survey of Indian Agriculture, Ministry of Information and Broadcasting, Government of India, **5** : 64.

ANONYMOUS, 2014b, Indian Agriculture, **5** : 305 - 313.

BRADFORD, 1986, Effect of seed coating with polymer, fungicide and insecticide on seed quality in cotton during storage. *Karnataka J. Agric. sci.,* **20** (1) : 137 - 139

CHANDRASHEKHAR, S. S., 2008, Morphological and molecular characterization and effect sowing dates and seed pelleting on seed production of french bean (*Phaseolus vulgaris* L.) *Ph. D Thesis,* Univ. Agric. Sci. Dharwad.

CHIKKANNA, C. S., THIMMEGOUDA AND RAMESH, R., 2000, Hydrophilic polymer seed treatment on seed quality and yield in groundnut. *Seeds and Farms*, pp. 39 - 45.

IMRAN BAIG., 2005, Effect of grading methods, fungicides and polymer coating on storability of soybean [*Glycine max* (L.) Merill]. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci, Dharwad.

SHUSHMA, P. P., VYAKARANAL, B. S. AND VINODKUMAR, S. B., 2014, Influence of polymer coat and seed treatment chemicals on chickpea seed quality during storage. *Environ. and Ecol.,* **32** (4A) : 1592 - 1597.

TEKRONY, 2006, Seed film coating technology for maximizing the growth and productivity of maize. *Karnataka J. Agric. Sci.,* **18** (2) : 349 - 356.

VANANGAMUDI, K., SRIMATHI, P., NATARAJAN, N. AND BHASKARAN, M., 2003, Current scenario of seed coating polymer. *ICAR - Short Course on Seed Hardening and Pelleting Technologies for Rain Fed or Garden Land Ecosystems*, **4** : 80 - 100.

(*Received :*November, 2016 *Accepted :* February, 2017**)**