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Short Communication

Effect of seed coating on seed yield and related parameters in quality protein maize hybrid HQPM 1 (*Zea mays* L.)

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Abstract

A field experiment was conducted at Palampur during *kharif* 2015 to study the effect of different seed coating treatments on seed yield and related parameters in quality protein maize hybrid HQPM 1. The seeds were coated with polymer, fungicides, insecticide, polymer-fungicides and polymer-insecticide combinations. Seed coating had significant effect on days to 50% tasseling, days to 50 % silking, days to 75 % maturity, plant height (cm), cobs per plant, cob length (cm), cob girth (cm), number of rows per cob, number of seeds per row, seeds per cob, 100-seed weight (g) and seed yield (q/ ha). Seed coating with polymer + vitavax 200* @ 2 g/kg of seed and vitavax 200* @ 2 g/kg of seed recorded significantly higher seed yield (q/ha), plant height (cm), cobs per plant, cob length (cm), cob girth (cm), number of rows per cob, number of seeds per row, seeds per cob and 100-seed weight (g) in comparison to the untreated control.

Key words: HQPM 1 maize hybrid, seed coating, seed yield and related parameters.

Maize (*Zea mays* L.) is one of the most important cereals of the world. It has worldwide significance as human food, animal feed and as a raw material for large number of industrial products. In India, maize occupies an area of 9.19 million hectares with a total production of 20.63 million tonnes and an average yield of 24.17 quintals/ hectare (Anonymous 2016). In Himachal Pradesh, it is grown in an area of 300.0 thousand hectares contributing 752.7 thousand tonnes of production with a productivity of 25.09 quintals/hectare (Anonymous 2016a).It is a versatile, miracle crop and thus termed as "Queen of Cereals". However, the protein quality of maize is considered poor due to the presence of large concentrations of an alcohol soluble protein fraction called prolamine also known as 'Zein' in the endosperm (Prassana *et al.*2001). Zein, deficient in two essential amino acids, *viz.*, lysine and tryptophan. Quality protein maize (QPM) on the other hand has nearly twice the amount of lysine and tryptophan which make the protein of QPM equivalent to 90% of milk protein (Bressani 1990).These two limiting amino acids are known to be regulated by opaque 2 genes and associated modifiers. QPM is utilized for diversified purposes in food and nutritional security as infant food, health food/mixes, convenience foods, speciality foods and emergency ration.

Modern seed production systems require a high degree of precision in crop establishment. The need for high plant population densities and uniform plant stand requires high quality maize seeds that will consistently produce rapid and uniform seedling emergence from each seed sown. The use of high physiological quality seeds is among the best practices for obtaining maximum crop yields. These seeds are more likely to achieve a high performance when exposed to different environmental conditions, expressed in a high percentage and speed of emergence, good stand establishment, good initial seedling development and increased final production (Tillmann and Miranda 2006). It is the seed physiological and seed sanitary quality that will determine their performance in the field, that is, the proper establishment of plants, which is essential for satisfactory levels of productivity and final product

quality (Nascimento *et al.* 2011). After sowing, seeds are still exposed to biotic and abiotic environmental factors (Delouche 2005) and agricultural soils have many pathogenic microorganisms that may interact with seeds and seedlings (Munkvold and O'Mara 2002) and reduce their performance by causing seed rot, seedling death or root rot (Pinto 2000). Phytophagous insects in the soil can also damage seedlings (Girolami *et al.* 2009) and significantly reduce the plant population. Under these situations, seed coating with polymer, fungicides and insecticide is an alternative for improving seed and seedling performance of quality protein maize (QPM) under field conditions. The purpose of treating seeds chemically is to eradicate their pathogens and/or protect them against soil pathogens, mainly during their germination. Seed coating particularly with polymer provides protection against the stress imposed by accelerated ageing, which includes fungal invasion. It improves plant stand and field emergence of seeds, helps to make room for including all required ingredients, protectants, nutrients, plant growth promoters, hydrophobic/hydrophilic substances, oxygen suppliers etc. By encasing the seed within a thin film of biodegradable polymer, the adherence of seed treatment to the seed is improved, ensures dust free handling, make treated seed both useful and environment friendly. Polymer coating makes sowing operation easier due to the smooth flow of seeds. The polymer film coat may act as a physical barrier, which has been reported to reduce the leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo (Deshpande and Jamadar 2014).Therefore, the present study was undertaken to determine the effect of seed coating treatments on seed yield and related parameters in HQPM1 maize hybrid.

The present investigation was carried out during *kharif* 2015 at Experimental Farm of Department of Seed Science and Technology, CSKHPKV, Palampur. Freshly harvested seed produce of quality protein maize hybrid HQPM 1, procured from CSKHPKV, Regional Research Station, Bajaura (Kullu) were dried to about 10 % moisture content, graded to uniform size and used for the conducting the present study. Ten treatments *viz.*, T_0 - control (untreated seeds), T_1 - polymer coating (polykote @ 3 ml per kg of seed, diluted with 5 ml of water), T_2 - flowable thiram (Royal flow 40 SC) @ 2.4 ml per kg of seed, T_3 - polymer + flowable thiram (Royal flow 40 SC) @ 2.4 ml per kg of seed, T_4 - vitavax 200* (containing thiram 37.5% and carboxil 37.5%) @ 2 g per kg of seed, T_5- polymer + vitavax 200* (containing thiram, 37.5% and carboxil, 37.5%) @ 2g per kg of seed, T_6 - imidacloprid (17.8% SL) @ 6 ml per kg of seed, T_7 - polymer + imidacloprid (17.8% SL) @ 6 ml per kg of seed, T_8 - polymer + flowable thiram (Royal flow 40 SC) @ 2.4 ml per kg of seed + imidacloprid (17.8% SL) @ 6 ml per kg of seed and T_9 - polymer + vitavax 200* (containing thiram, 37.5% and carboxil, 37.5%) @ 2 g per kg of seed + imidacloprid (17.8% SL) @ 6 ml per kg of seed were evaluated in randomized block design (RBD) with three replications. The coated seeds were dried to the original moisture content by keeping in shade for 72 hours and thereafter used for sowing. Ten plants from each plot were selected randomly to record the data on plant height (cm), cobs per plant, cob length (cm), cob girth (cm), number of rows per cob, number of seeds per row and seeds per cob, while days to 50% tasseling, days to 50 % silking, days to 75 % maturity, 100 seed weight (g) and seed yield (q/ ha) were recorded on plot basis.

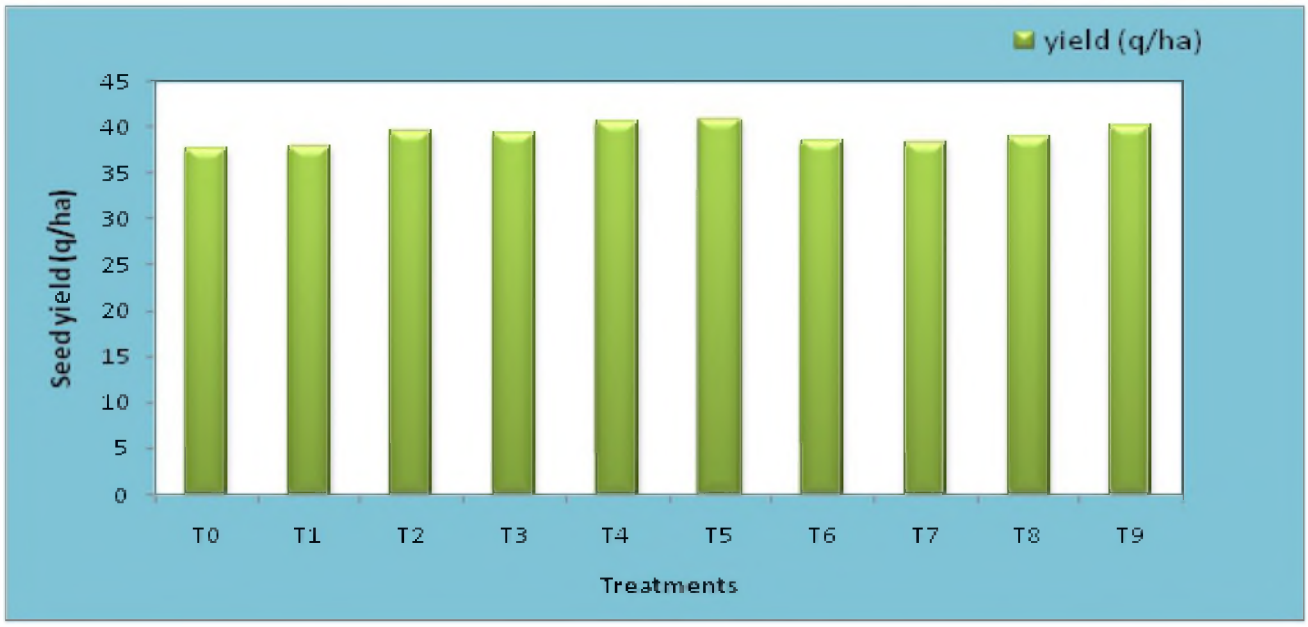
Seed coating significantly affected the seed yield and related parameters of HQPM 1 maize hybrid (Table 1 and fig. 1). Significantly minimum days to 50% tasseling were recorded in T_5 - polymer + vitavax 200* @ 2 g/kg of seed (49.33), followed by T_4 - vitavax 200* @ 2 g/kg of seed (49.67) as compared to untreated control (53.67). Minimum days to 50% silking were recorded in T_5 - polymer + vitavax 200* @ 2 g/kg of seed (57.33), followed by T_4 - vitavax 200* @ 2 g/kg of seed (57.67) in comparison to untreated control (62.67). Similar findings were reported by Shakuntala *et al.* (2010) in sunflower. Significantly minimum days to 75% maturity were recorded for seed coated with polymer + vitavax 200* @ 2 g/kg of seed (81.67), followed by T_4 - vitavax 200* @ 2 g/kg of seed (82.33) as compared to untreated control (86.33).Plant height varied significantly for all the treatments. Average plant height (cm) recorded was 256.7 cm. Seed coated with polymer + vitavax 200* @ 2 g/kg of seed recorded maximum plant height (262.1 cm), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (260.4 cm) as compared to untreated control (252.4 cm). Similar

Table 1. Effect of seed coating on seed yield and related parameters in HQPM 1 maize hybrid

Treatments	Days to 50% tasseling	Days to 50% silking	Days to 75% maturity	Plant height (cm)	Cobs/ plant	Cob length (cm)	Cob girth (cm)	No. of rows/ Cob	No. of seeds/ row	Seeds/ Cob	100-seed weight (g)	Seed yield (q/ha)
T_0	53.67	62.67	86.33	252.4	1.0	13.48	11.95	13.78	26.86	370.21	19.76	37.6
T_1	53.00	62.33	86.00	253.0	1.0	13.86	12.29	13.87	26.92	373.46	19.84	37.8
T_2	49.67	60.00	84.00	258.2	1.1	14.51	12.78	14.58	27.82	405.82	20.32	39.6
T_3	50.33	61.00	84.33	257.2	1.1	14.45	12.68	14.34	27.78	398.39	20.29	39.3
T_4	49.67	57.67	82.33	260.4	1.5	14.83	12.97	14.73	28.12	414.19	20.50	40.5
T_5	49.33	57.33	81.67	262.1	1.8	15.19	13.27	14.83	28.33	419.99	20.68	40.7
T_6	51.67	61.33	85.33	255.1	1.1	14.29	12.46	14.10	27.19	383.47	20.01	38.5
T_7	52.67	62.00	85.33	254.0	1.0	14.12	12.37	13.95	27.08	377.62	19.93	38.2
T_8	50.67	61.67	84.33	256.0	1.3	14.36	12.56	14.15	27.27	385.42	20.19	38.9
T_9	49.67	58.00	83.33	259.0	1.4	14.62	12.88	14.68	27.98	410.47	20.43	40.1
Mean	51.03	60.40	84.30	256.7	1.24	14.37	12.62	14.30	27.53	393.90	20.20	39.12
SE(m)±	0.54	0.71	0.51	1.90	0.10	0.29	0.20	0.20	0.30	7.10	0.05	0.52
CD (P=0.05))	1.61	2.11	1.51	5.51	0.29	0.87	0.71	0.71	0.76	21.16	0.14	1.54

T_o - control (untreated seeds), T_1 - polymer coating (polykote @ 3 ml/kg of seed, diluted with 5 ml of water), T_2 - flowable thiram (Royal Flow 40 SC) @ 2.4 ml/ kg of seed , T_3 - polymer + flowable thiram (Royal Flow 40 SC) @ 2.4 ml/ kg of seed , T_4 - vitavax 200* (containing thiram 37.5% and carboxil 37.5%) @ 2 g/kg of seed, T_5 - polymer + vitavax 200* (containing thiram 37.5% and carboxil 37.5%) @ 2 g/kg of seed, T_6 - imidacdloprid (17.8% SL) @ 6 ml/kg of seed, T_7 - polymer + imidacloprid (17.8% SL) @ 6 ml/kg of seed, T_8 - polymer + flowable thiram (Royal Flow 40 SC) @ 2.4 ml/ kg of seed + imidacloprid (17.8% SL) @ 6 ml/kg of seed and T_9 - polymer + vitavax 200* (containing thiram 37.5% and carboxil 37.5%) @ 2 g/kg of seed + imidacloprid (17.8% SL) @ 6 ml/kg of seed

Fig. 1.Effect of seed coating on seed yield (q/ha) in HQPM 1 maize hybrid



results were reported by Chaudhry *et al.* (1995) in maize, Kumar *et al.* (2014) in pigeon pea, Rivas *et al.* (1998) in hybrid maize and Wiatrak (2013) in soybean, where polymers treated seeds resulted in increased plant height.

The number of cobs per plant recorded was significantly influenced by seed coating treatments (Table 1). Significantly higher number of cobs per plant was recorded for seed coated with polymer + vitavax 200* @ 2 g/kg of seed (1.8), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (1.5) in comparison to untreated control (1.0). The cob length was significantly influenced by the seed coating treatments. Significantly highest cob length was recorded for seed coated with polymer + vitavax 200* @ 2 g/kg of seed (15.19 cm), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (14.83 cm) as compared to untreated control (13.48 cm). Seed coating treatments significantly influenced the cob girth. Seed coated with polymer + vitavax 200* @ 2 g/kg of seed (13.27 cm) recorded significantly highest cob girth, which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (12.97 cm) in comparison to untreated seeds (11.95 cm). The number of rows per cob was significantly influenced by seed coating treatments. Number of rows per cob were significantly higher for seed coated with polymer + vitavax 200* @ 2 g/kg of seed (14.83), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (14.73) over untreated control (13.78).

Seed coating treatments significantly influenced the number of seeds per row (Table 1). Significantly highest number of seeds per row was recorded in seed coated with combination of polymer + vitavax 200* @ 2 g/kg of seed (28.33), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (28.12) as compared to untreated control (26.86). Significantly highest number of seeds per cob was recorded for polymer + vitavax 200* @ 2 g/kg of seed (419.99), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (414.19) in comparison to untreated control (370.21). Average weight of 100 seeds recorded for all treatments was 20.20 g. Seeds coated with polymer + vitavax 200* @ 2 g/kg of seed exhibited significantly highest 100-seed weight (20.68 g), followed by T_4 - vitavax 200* @ 2 g/kg of seed (20.50 g) as compared to untreated control (19.76 g). Similar results were also obtained by Ramesh *et al.* (2011) in groundnut and Wiatrak (2013) in soybean, where seeds coated with polymer @ 20 g per kg of seeds recorded higher test weight. The seed yield per hectare was computed from the seed yield per plot. Seed coated with polymer + vitavax 200* @ 2 g/kg of seed recorded significantly higher seed yield (40.7 q), which was at par with T_4 - vitavax 200* @ 2 g/kg of seed (40.5 q) in comparison to untreated control (37.6 q). Similar results were also reported by Kumar *et al.* (2014) in pigeon pea, Shakuntala *et al.* (2010) in sunflower and Shushma *et al.* (2014) in wheat. Increase in seed yield due to seed coating was mainly due to significant

increase in yield parameters of maize hybrid HQPM 1. The cob length, cob girth, number of seeds per cobs and 100-seed weight were the major yield components which significantly contributed to the seed yield. Better performance was recorded for the seed treatments with polymer and vitavax 200* which might be due to slower imbibition rate, lesser seed leakage, lesser fungal invasion and insect attack.

It can be concluded from the present study that for enhancing seed yield of HQPM 1 maize hybrid, seeds can either be treated with polymer coating @ 3 ml/kg of seed + vitavax 200* @ 2 g/kg of seed or vitavax 200* @ 2 g/kg of seed.

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References

Anonymous 2016a. Director Review 2015-16: ICAR-Indian Institute of Maize Research, New Delhi, India.

Anonymous 2016. http://www.pecad.fas.usda.gov/. Foreign Agricultural Service, U.S. Department of Agriculture (USDA), USA.

Bressani R 1990. Nutritional value of high-lysine maize in humans. In *Quality Protein Maize* (ed. Mertz, E. T.), American Association of Cereal Chemists, MN, USA, p. 205-225.

Chaudhry MA, Ahmad T and Khan MFA 1995. Effect of polymers on germination, plant height and permanent wilting point of maize (*Zea mays* L.) and soybean (*Glycine max*). Pakistan Journal of Scientific and Industrial Research **38**: 308-311.

Delouhe JC 2005. Seed quality and performance. Seed News **9**: 34-35.

Deshpande VK and Jamadar MI 2014. Effect of botanical seed treatment on storability of chickpea (*Cicer arietinum)*. Research Journal of Agricultural Sciences **5**: 416-419.

Girolami V, Mazzon L, Squartini A, Mori N, Marzaro M, Di Bernardo A, Greatti M, Giorio C and Tapparo A 2009. Translocation of neonicotinoid insecticides from coated seeds to seedling guttation drops: a novel way of intoxication for bees. Journal of Economic Entomology **5**:1808-1815.

Kumar TP, Asha AM, Maruthi JB and Vishwanath K 2014. Influence of seed treatment chemicals and containers on seed quality of marigold during storage. An International Journal of Life Sciences **9**: 937-942.

Munkvold GP and O'Mara JK 2002. Laboratory and growth chamber evaluation of fungicidal seed treatments for maize seedling blight caused by *Fusarium* species. Plant Disease **86**:143-150.

Nascimento WM, Dias DCFS, Silva PP 2011. Qualidade da semente e estabelecimento de plantas de hortaliças no campo. In.: Nascimento WM. Hortaliças: tecnologia de produção de sementes. Embrapa Hortaliças Bras. pp. 79-106.

Pinto NFJA 2000. Tratamento fungicida de sementes de milho contrafungos do solo e o controle de Fusarium associado as sementes. Scientia Agricol **53**:483-486.

Prasanna B, Vasal S, Kasahun B and Singh NN 2001. Quality protein maize. Current Science **81**: 1308-1319.

Ramesh R, Rajashri CS and Rangnath 2011. Hydrophilic polymer seed treatment on seed quality and yield in pearl millet, cowpea and groundnut. Seed Research **8**: 32-35.

Rivas BA, McGee DC and Burris JS 1998. Treatment of maize seeds with polymers for control of *Pythium* spp. Fitopatologia Venezolana **11**: 10-15.

Shakuntala NM, Vyakaranahal BS, Shankergoud I, Deshpande VK, Pujari BT and Nadaf HL 2010. Effect of seed polymer coating on growth and yield of sunflower hybrid RSFH-130. Karnataka Journal of Agricultural Science **23:** 708-711.

Shushma PP, Vyakaranal BS and Vinodkumar SB 2014. Influence of polymer coat and seed treatment chemicals on chickpea seed quality during storage. Environment and Ecology **32**: 1592-1597.

Tillmann, MAA and Miranda DM 2006. Análise de sementes. In: Peske. S.T.; Lucca Filho, O.A.; Barros, ACSA. (Ed.). *Sementes:* fundamentos científicos e tecnológicos, Pelotas: UFPel, p.159-255.

Wiatrak P 2013. Effect of polymer seed coating with micronutrients on soybeans in southeastern coastal plains. American Journal of Agricultural and Biological Sciences **8**: 302-308.