

Effect of Seed Pelleting on Seed Quality and Field Performance of Onion (*Allium cepa*)

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ABSTRACT: An attempt was made to study the effect of seed pelleting on seed quality and field performance of two seed lots of onion seeds. Between the two seed lots, Fresh seed lot (L_1) recorded significantly higher seed quality parameters and yield characters as compared to old seed lot (L_2). Among the pelleting, pelleting with $ZnSO_4$ (10 g/kg) recorded significantly highest growth and yield characters viz., field emergence, equatorial diameter, polar diameter, bulb yield per plant and bulb yield per hectare compared to other treatments. Therefore, pelleting with $ZnSO_4$ helps in increase the field performance of onion var. Bhima Super.

Keywords: Bulb weight, Bulb yield. Germination, Onion, Seed pelleting, Vigour index

Onion (*Allium cepa* L.) is one of the major bulb crops of the world and important commercial vegetable grown all over the world and also known as “Queen of the Kitchen” and is a member of family “Amaryllidaceae”. Indian onions are famous for their pungency due to the presence of a volatile oil ‘Allyl propyl disulphide’ ($C_6H_{12}S_2$) and are available round the year. It occupies a premier position amongst the vegetables due to its high preference in food, remunerative price and regular demand in the market. Worldwide onion is grown on 49.60 lakh ha area with 931.70 lakh Million Tonnes production and productivity of 18.80 MT ha⁻¹ [1].

Onion seeds are small in size and irregular in shape difficulty in singling creates problem in precision sowing and crop establishment. To overcome these difficulties, seed pelleting is advocated. Pelleting is a mechanism of applying needed materials in such a way that they affect the seed or soil at the seed-soil interface. Thus, seed pelleting provides an opportunity to package, effective quantities of materials such that they can influence the micro-environment of each seed [2]. Micronutrients play important role in plant growth possibly in protein synthesis, cell elongation membrane function and resistance to abiotic stresses [3]. In addition, higher seed Zn contents leads to better resist invasion of soil-borne pathogens during germination and seedling development thus ensuring good crop stand [4]. and ultimately better yield. Iron is a catalyst to chlorophyll formation, acts as an oxygen carrier, aids in respiratory enzyme systems,

photosynthesis [5]. Plant growth regulators (PGR's) are known to improve physiological efficiency including photosynthetic ability of plants and offer a significant role in realizing higher crop yields also responsible for stimulating cell division, cell elongation. For the profitable cultivation, it is highly desirable to find the ways and means to enhance the productivity of onion by using certain techniques that are within to reach of farmers. To achieve this, one of the options is to use balanced nutrient supply of macro and micronutrients along with growth regulators. Keeping in this view present investigation was undertaken to know the effect of pelleting on seed quality, plant growth and bulb yield of onion.

MATERIAL AND METHODS

The laboratory experiment was carried out at Seed Quality and Research Laboratory of National Seed Project (Crops) Seed Unit, University of Agricultural Sciences, Dharwad. The experiment was laid out in a Factorial Completely Randomized Design involved two seed lots as one factor and seed pelleting as second factor. The field study was carried out at Saidapur Farm in Factorial Randomized Block Design with three replications. Both fresh and old seed lot were subjected to eight seed pelleting treatments. Following seed treatments were imposed by Incotec company with

P₁: Pelleting with micronutrient Zn (10 g/kg), P₂: Pelleting with micronutrient Fe (10 g/kg) P₃: Pelleting with micronutrient Mn (10 g/kg), P₄: Bio-pelleting with

Trichoderma harzianum 10g/kg, P₅: Biopelleting with incotec product I, P₆: Pelleting with growth regulator GA₃ (50ppm), P₇: Control only pelleting with inert matter, P₈: Absolute control (without pelleting).

Laboratory observations on seed germination percentage, seedling length and seedling dry weight was assessed as per the standard procedures [6]. Seedling vigour indices were recorded as per Abdul-Baki and Anderson [7]. The data on growth and yield attributing parameters were recorded as per the standard procedures.

Data obtained were tabulated and subjected to statistical analysis by following the standard ANOVA method in Randomized Complete Block Design with Factorial concept and Critical Difference (CD) at 5 per cent were calculated.

RESULTS AND DISCUSSION

The data on seed quality parameters were significantly influenced by seed lots and seed pelleting but their interaction did not differ significantly. The results of seed quality parameters due to seed pelleting in fresh and old seed lot showed significant difference on germination, root length, shoot length, seedling vigour index-I, seedling dry weight, seedling vigour index-II. These parameters were significantly higher in fresh seed lot (91.33%, 8.15 cm, 10.64 cm, 1738, 25.67 mg, 2465 respectively) as compared to old seed lot (86.75%, 8.23 cm, 10.17 cm, 1600, 23.97 mg, 2107 respectively) as shown in table 1. The quality parameters in fresh seed lot were superior than old seed lot because of higher enzyme activity and faster growth rate in fresh seed lot [8]. Similar findings were also reported in fenugreek [9] and coriander [10].

Seed pelleting marked significant difference on seed quality parameters. Among the seed pelleting treatments seed pelleting with *Trichoderma harzianum* (10g/kg) recorded the higher seed quality parameters like germination percentage (94.33%), root length (9.20 cm), shoot length (11.39 cm), seedling vigour index-I (1946), seedling dry weight (26.07 mg) and seedling vigour index-II (2719) which was at par with P₁ (pelleting with ZnSO₄ 10 g/kg recorded germination (91.67%), root length (8.79 cm), shoot length (10.91 cm), seedling vigour index-I (1806), seedling dry weight (25.87 mg) and seedling vigour index-II (2553 and lowest was recorded in control (Table 1). The benefits of *Trichoderma harzianum* were

due to production of growth regulators which were cytokinin-like molecules, e.g. zeatyn and gibberellin (GA₃ or GA₃-related growth regulators). Earlier studies have been reported that this fungi also induces localized or systemic resistance in plant system [11, 12]. The early and higher germination percentage were due to beneficial effects multiple modes of action [13, 14]. Studies were in line with Dubey *et al.* [15] who reported that chilli seed treatment with *Trichoderma* strains increased vigour index compared to no seed treatment. Mukhtar [16] investigated that okra seed treatment with *T. harzianum* gave the highest germination and vigour index and also reported that *T. harzianum* was useful in enhancing the germination percentage as well as reduce loss caused by delayed germination. The present findings are in accordance with Ramalingam and Bollipo [17] in chilli. There was no significant influence of interaction effect between seed lots and seed pelleting on seed quality parameters like germination percentage, root length, shoot length, seedling vigour Index-I, seedling dry weight, seedling vigour index-II. The data on field emergence (80.79%) were significantly higher in fresh seed lot over one year old seed lot (78.04%). Tejeshwini [18] reported the similar results in onion crop and observed that onion seeds with high seed quality parameters perform better in the field and helped in achieving better growth and development of crop.

The bulb yield and yield attributes were significantly influenced fresh and old seed lots. Fresh seed lot recorded maximum values of yield attributes like weight of bulb (339.67 g), equatorial diameter (5.51 cm), polar diameter (4.67 cm), bulb yield per plant (73.37 g) and bulb yield per ha 31.47 t) and lower values were recorded in old seed lot (271.29 g, 5.33 cm, 4.45 cm, 68.83 g, 30.05 t). Improvement in bulb yield of fresh seed lot was due to enhanced growth parameters and yield attributes in fresh seed lot as compared to one year old seed lot. The results were in line with findings of Singh [19] in onion crop.

Growth parameters like, field emergence were significantly varied due to application of seed pelleting. Field emergence was significantly higher in pelleting with ZnSO₄ (84.33%) followed by as P₆ (Pelleting with GA₃ 50 ppm) (83.33%) and lowest was recorded in P₈ (76.50%) with absolute control as shown in fig.1. The increased growth parameters in pelleting with ZnSO₄ is due to zinc is regarded as component of variety of enzymes which

Table 1. Influence of seed pelleting on seed quality parameters

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling vigour index I	Seedling dry weight (mg/10 seedlings)	Seedling vigour index II
L ₁	91.33 (72.37)	8.41	10.64	1742	25.67	2465
L ₂	86.75 (68.19)	8.23	10.17	1600	23.97	2107
Mean	89.04 (70.6)	8.33	10.40	1671	24.82	2286
S.Em. ±	0.38	0.06	0.05	9.90	0.22	22.16
C.D.@1%	1.46	0.22	0.20	38.33	0.83	85.80
P ₁	91.67 (74.13)	8.79	10.91	1806	25.87	2553
P ₂	89.50 (70.08)	8.71	10.84	1704	25.17	2226
P ₃	90.00 (73.50)	8.64	10.67	1747	25.57	2258
P ₄	94.33 (75.57)	9.20	11.39	1946	26.07	2719
P ₅	88.83 (68.36)	8.29	10.13	1597	24.72	2270
P ₆	89.17 (71.13)	7.88	10.01	1595	25.08	2402
P ₇	87.83 (68.51)	7.78	9.85	1530	23.26	1985
P ₈	85.00 (66.96)	7.55	9.45	1444	22.87	1874
Mean	89.04 (70.63)	8.33	10.40	1671	24.82	2286
S.Em. ±	0.85	0.11	0.10	19.80	0.43	44.3
C.D.@1%	3.30	0.44	0.40	76.67	1.67	171.6
L ₁ P ₁	94.33 (76.80)	9.09	11.06	1788	26.33	2754
L ₁ P ₂	92.67 (74.12)	8.95	11.03	1902	26.62	2427
L ₁ P ₃	92.33 (73.25)	8.99	10.73	1846	26.10	2358
L ₁ P ₄	96.00 (78.15)	9.29	11.72	2023	27.33	2986
L ₁ P ₅	89.33 (70.82)	8.48	10.57	1696	25.06	2484
L ₁ P ₆	91.67 (73.25)	7.73	10.21	1642	25.83	2636
L ₁ P ₇	87.67 (68.91)	7.66	10.03	1557	24.45	2116
L ₁ P ₈	88.67 (70.12)	7.26	9.80	1484	24.00	1955
L ₂ P ₁	89.00 (71.12)	8.10	10.77	1620	24.80	2452
L ₂ P ₂	87.67 (69.23)	8.48	10.65	1710	25.11	2025
L ₂ P ₃	86.33 (68.25)	8.40	10.60	1648	25.04	2158
L ₂ P ₄	92.67 (74.58)	9.11	11.06	1870	24.33	2351
L ₂ P ₅	84.33 (66.38)	8.13	9.70	1499	24.37	2055
L ₂ P ₆	86.67 (68.25)	8.03	9.80	1548	24.33	2168
L ₂ P ₇	84.00 (66.58)	7.90	9.67	1504	22.07	1854
L ₂ P ₈	83.33 (65.28)	7.83	9.10	1403	21.73	1792
Mean	89.16 (70.63)	8.33	10.40	1671	24.82	2286
S.Em. ±	1.06	0.16	0.15	28.00	0.61	62.7
C.D. @ 5%	NS	NS	NS	NS	NS	NS

P₁: Pelleting with micronutrient Zn (10 g/kg)P₂: Pelleting with micronutrient Fe (10 g/kg)P₃: Pelleting with micronutrient Mn (10 g/kg)P₄: Bio-pelleting with *Trichoderma harzianum* 10g/kg

* Figures in parenthesis indicates arc sine values

P₅: Biopelleting with incotec product IP₆: Pelleting with growth regulator GA₃ (50ppm)P₇: Control only pelleting with inert matterP₈: Absolute control (without pelleting)

Table 2. Effect of pelleting on yield attributes and bulb yield of onion

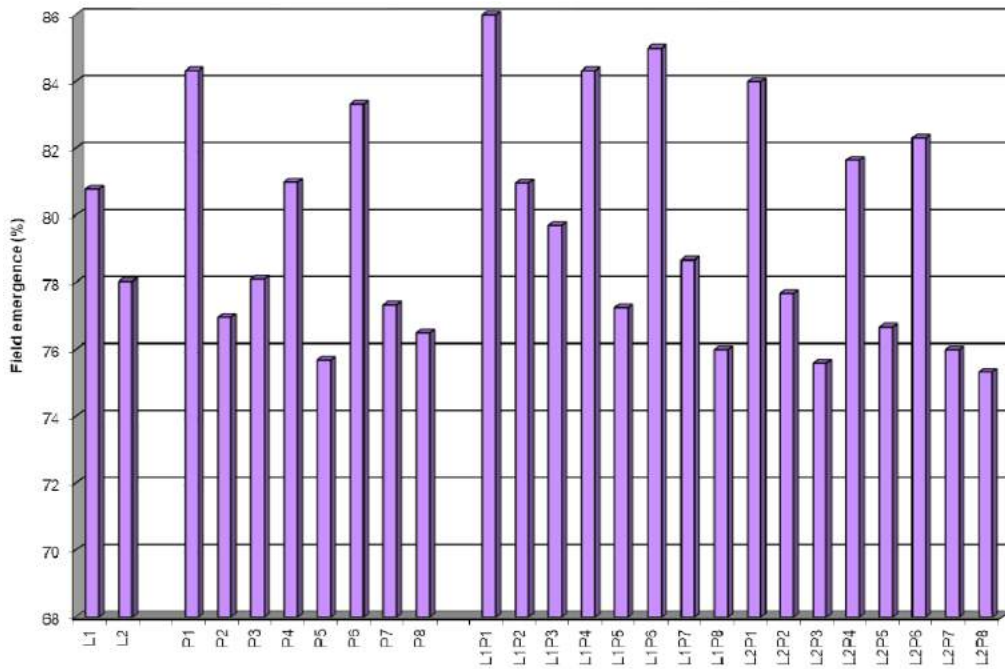
Treatments	Polar diameter (cm)	Equatorial diameter (cm)	Bulb yield/plant (g)
L ₁	4.67	5.51	73.37
L ₂	4.45	5.33	68.83
S.Em. ±	0.03	0.04	0.32
C.D.@ 5%	0.07	0.13	0.93
P ₁	5.09	5.68	77.26
P ₂	4.84	5.40	71.03
P ₃	4.77	5.34	69.48
P ₄	4.88	5.62	74.06
P ₅	4.39	5.29	67.97
P ₆	5.00	5.64	76.62
P ₇	3.80	5.24	67.03
P ₈	3.73	5.15	65.36
Mean	4.56	5.42	71.1
S.Em. ±	0.05	0.09	0.65
C.D. @ 5%	0.15	0.25	1.86
L ₁ P ₁	5.21	5.73	79.00
L ₁ P ₂	4.94	5.54	73.60
L ₁ P ₃	4.97	5.47	71.60
L ₁ P ₄	5.03	5.67	74.50
L ₁ P ₅	4.50	5.40	70.60
L ₁ P ₆	5.15	5.69	78.30
L ₁ P ₇	3.84	5.38	70.20
L ₁ P ₈	3.76	5.22	69.10
L ₂ P ₁	4.92	5.64	75.50
L ₂ P ₂	4.75	5.26	68.50
L ₂ P ₃	4.50	5.20	67.40
L ₂ P ₄	4.82	5.57	73.60
L ₂ P ₅	4.29	5.18	65.30
L ₂ P ₆	4.85	5.60	74.90
L ₂ P ₇	3.75	5.11	63.80
L ₂ P ₈	3.70	5.09	61.70
Mean	4.56	5.42	71.10
S.Em. ±	0.07	1.15	0.91
C.D.@ 5%	0.21	NS	2.63

P₁: Pelleting with micronutrient Zn (10 g/kg)P₂: Pelleting with micronutrient Fe (10 g/kg)P₃: Pelleting with micronutrient Mn (10 g/kg)P₄: Bio-pelleting with *Trichoderma harzianum* 10g/kgP₅: Biopelleting with incotec product IP₆: Pelleting with growth regulator GA₃ (50ppm)P₇: Control only pelleting with inert matterP₈: Absolute control(without pelleting)

helps in protein synthesis and in the utilization of phosphorous and nitrogen metabolism. It is also known to enhance the plant growth on account of its major role in auxin metabolism. Zinc involved in enhancing the seedling establishment and possibly due to higher metabolic activity in the seed [20, 21]. Zn helps in development of cell wall, cell differentiation, root elongation and shoot growth, through active photosynthesis resulting in increased plant height in tomato [22]. Yield attributes like weight of bulb (346.83 g), equatorial diameter (5.68 cm), polar diameter (5.09 cm), bulb yield per plant (77.26 g) and bulb yield/ha (33.04 t) significantly higher in seed pelleting with ZnSO₄ (10 g/kg) which was on par with P₆ (pelleting with GA₃ at 50 ppm) recorded weight of bulb (343.17 g), equatorial diameter (5.64 cm), polar diameter (5.00 cm), bulb yield per plant (76.62 g) and bulb yield/ha (32.07 t) and lowest in control P₈. The highest bulb yield recorded in seed pelleting with ZnSO₄ treatment can be correlated with enhanced yield attributes. The seed pelleting with ZnSO₄ was found to be effective due to easy availability of Zn to plant which lead to vigorous growth of plant which advanced reproductive phase and enhanced the metabolic activity of the plant [23, 24, 25] of onion. There was significant effect of interaction due to seed lots and seed pelleting on growth parameters like field emergence and yield attributes like weight of bulb, and polar diameter. All these parameters were highest in fresh seed lot combined with pelleting of ZnSO₄ recorded highest field emergence (86.00%), weight of bulb (371.17 g), polar diameter (5.21 cm) bulb yield per plant (79.00 g) and bulb yield per ha (33.90 t) followed by L₁P₆ (Fresh seed lot with GA₃ @ 50 ppm recorded (85.00%, 368.3 g 5.03 cm 78.30 g, 32.88 t) and lowest was recorded in old seed lot with control. The best performance in fresh seed lot combined with pelleting of ZnSO₄ was due to increased availability of bio-nutrients in pelleted seeds which improved growth resulting in higher yield.

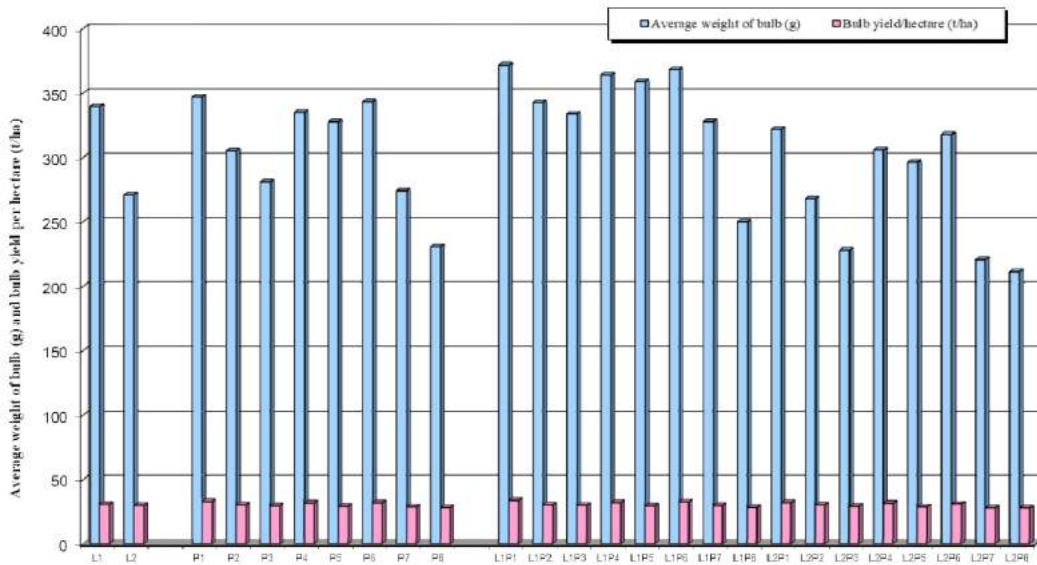
CONCLUSION

It can be concluded that fresh seed lot combined with *Trichoderma harzianum* (10g/kg) recorded higher seed quality parameters, whereas in field performance fresh seed lot combined with ZnSO₄ (10 g/kg) recorded significantly highest growth and yield characters viz., field emergence, equatorial diameter, polar diameter, bulb yield per plant and bulb yield per hectare which leads to enhance the field performance of onion.



P₁: Pelleting with micronutrient Zn (10 g/kg) P₅: Biopelleting with incotec product I
 P₂: Pelleting with micronutrient Fe (10 g/kg) P₆: Pelleting with growth regulator GA₃ (50ppm)
 P₃: Pelleting with micronutrient Mn (10 g/kg) P₇: Control only pelleting with inert matter
 P₄: Bio-pelleting with *Trichoderma harzianum* 10g/kg P₈: Absolute control (without pelleting)

Figure 1. Effect of seed pelleting in field emergence of onion



P₁: Pelleting with micronutrient Zn (10 g/kg) P₅: Biopelleting with incotec product I
 P₂: Pelleting with micronutrient Fe (10 g/kg) P₆: Pelleting with growth regulator GA₃ (50ppm)
 P₃: Pelleting with micronutrient Mn (10 g/kg) P₇: Control only pelleting with inert matter
 P₄: Bio-pelleting with *Trichoderma harzianum* 10g/kg P₈: Absolute control (without pelleting)

Figure 2. Effect of seed pelleting in bulb attribute and bulb yield of onion

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