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Influence of seed enhancement techniques on field performance of onion (*Allium cepa* L.)

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Abstract
An experiment was carried out at Saidapur Farm, University of Agricultural Sciences, Dharwad to study the effect of seed enhancement techniques on field performance of onion. Growth and yield parameters were significantly influenced between the seed lots and seed enhancement techniques. Fresh seed lot (L_1) recorded significantly higher growth and yield characters as compared to old seed lot (L_2). While encrusting with Thiram: Genius coat (1:1.2) (T_4) recorded significantly higher growth and yield characters *viz*., field emergence (86%), equatorial diameter (5.43 cm), polar diameter (5.03 cm), weight of bulb (347 g), bulb yield per plant(74 g) and bulb yield per hectare (23.61 t) compared to control recorded (78.10%,4.72 cm, 4.33 cm, 300.33 g,66.95 g,19.74 t) respectively. Therefore, encrusting with Thiram: Genius coat (T_4) (1:1.2) can be used in order to enhance field performance of onion var. Bhima Super.

Keywords: Onion, seed quality enhancement techniques, field emergence, bulb yield

Introduction
Onion (*Allium cepa* L.) (Family: Amaryllidaceae, 2n=16) is one of the major bulb crop of the world and important commercial vegetable grown all over the world and occupies a premier position amongst the vegetables due to its high preference in food, remunerative price and regular demand in the market. It's important characteristic is pungency in onion is due to volatile compound allyl propyl disulphide. Worldwide onion is grown on 49.60 lakh ha area with 931.70 lakh MT production and productivity of 18.80 MT ha $^{-1}$ (Anon., 2018) [2]. Major problem in onion is low quality seeds resulting in slow and asynchronous germination as well as seeds producing a high number of abnormal seedlings (Borowski and Michałek, 2006) [4]. Seedling establishment is an important factor in bulb production of onion, it largely depends on the seed germination and vigour. Onion seeds are small in size, irregular in shape hence difficult in singling and crop establishment. Seed enhancement technique like encrusting commonly used in situations when growers primarily intend to reduce doubles or multiples when planting and to achieve exact and consistent seed spacing. There by encrusting make the onion seed heavy; no need for nursery raising direct sowing will save up to 20-25 days. Film coating is more practical to eliminate pesticide dust hazards associated with treating, packaging and planting seed, as well as added protection against mechanical handling (Taylor *et al.*, 2001) [16]. Therefore, seed enhancement techniques are used to reduce emergence time, accomplish uniform emergence and give better crop stand (Ashraf and Foolad, 2005). Keeping in view of the above facts, the present investigation was carried with an objective to find out the effect of seed enhancement techniques on field performance of onion.

Material and Methods
The field study was carried out at Saidapur Farm in Factorial Randomized Block Design with three replications. The experiment involved two seed lots as one factor and seed enhancement techniques as second factor. Both fresh and old seed lot were subjected to six seed enhancement treatments. Following seed treatments were imposed by Incotec company with T_1- Film coating (Disco product- I), T_2- Film coating (Disco product-II), T_3- Encrusting (Thiram: Mycorrhiza (1:1.2), T_4-Encrusting (Thiram : Genius coat 1:1.2),T_5- Encrusting (Thiram: Nanonutrient (1:1.2),T_6-control. The data on growth parameters like plant height and field emergence was recorded and yield attributing parameters data was recorded at the time of Harvest. Equatorial and polar diameter of bulb was measured using digital Vernier Caliper. Data obtained were tabulated and subjected to statistical analysis by following the standard

ANOVA method for Randomized Complete Block Design with Factorial concept and Critical Difference (C.D.) @ 5% were calculated.

Result and discussion

The data on field emergence as influenced by the seed lots and enhancement techniques are presented in Table 1. Field emergence (%) gives accurate and reproducible results in predicting the planting value under field condition. Significant variation was observed in the field emergence between fresh and aged seed lots and among seed enhancement treatments. A mean value of 83.56% and 80.22% field emergence in fresh and old seed lots was recorded. Significant variation is noticed with respect to plant height at 60 and 90 Days after sowing (26.69, 40.20 cm) and yield attributes like bulb yield per plant (72.77 g), weight of bulb (333.06 g), equatorial diameter (5.26 cm) and polar diameter (4.70 cm) and bulb yield/ha (24 t) were recorded highest values for fresh seed lot and lowest values were recorded in old seed lot. The higher bulb yield noticed in fresh seed lot (L1) over old seed lot may be ascribed due to significant increase in field emergence, polar diameter, equatorial diameter which lead to better bulb production. In onion among the yield components, bulb diameter and bulb weight had maximum contribution towards onion bulb yield (Singh, 2001) [15].

These results are in agreement with findings in different crops such as okra (Narwal, 1995) [9], Indian mustard (Verma *et al.*, 2003) [17], carrot (Maskri *et al.*, 2003) [8], turnip (Khan *et al.*, 2005) [5] and in four vegetables seed (carrot, cucumber, onion and tomato) by Alhamdan *et al.* (2011) [1]. The lower values for old seed lot might be due to ageing in old seed lot resulted in low seed vigour and initial slow growth rate which ultimately caused the slower ontogenetic development of seedling (Heydecker, 1973) [7]. In findings of Ravinder (1990) [13] and Krishna (1993) [6] on sunflower crop, in fresh seed lot recorded higher enzymatic activities, vigour and better performance might be due to changes in ribonucleic acids which increased enzymatic activity in fresh seeds as reported by Sanjaykumar (1996) [14] and similar result was reported by Pushpalatha (2008) in okra.

Seed enhancement techniques had greater influence on plant growth and bulb yield as showed in (Table 1), Among the seed enhancement techniques treatment T_4 [Encrusting (Thiram: Genius coat 1:1.2] gave significantly superior growth and yield parameters like field emergence (86.00%), plant height at 60 and 90 DAS (29.58 cm, 42.56 cm, followed by T_5: encrusting with Thiram: Nanonutrient (84.50%, 27.94 41.26 cm. Table 1 and yield attributes like weight of bulb (347 g),

equatorial diameter (5.43 cm), polar diameter (5.03 cm), bulb yield per plant (74 g), bulb yield per ha (23.61 t) was recorded highest in Encrusting (Thiram: Genius coat 1:1.2] and which was on par with T_5: encrusting with Thiram: Nanonutrient (343.33 g, 5.40 cm, 4.88 cm, 72.14 g, 22.86 t and poor performance was found in control. Yadav (2018) reported the superiority of Thiram and Genius coat encrusting in mustard crop. This is due to beneficial effect of genius coat might be through physiological and disease protection process and also positive effect of Thiram it act as a protective agent against various fungal diseases prevent the fungal invasion thus enhanced growth and development of the crop which ultimately resulted in better crop yield, similar result reported by Patil *et al.* (2004) [10], Raghavani *et al.* (2002) [12]. Among the interaction fresh seed lot combined with Thiram: Genius coat (1:1.2) (L_1T_4) recorded significantly highest plant height @ 60 and 90 DAS (30.30, 43.88 cm), field emergence (86.67%), weight of bulb (350.33 g), equatorial diameter (5.48 cm), polar diameter (5.12 cm), bulb yield per plant (72.00 g), yield per hectare (22.88 t).

Table 1: Effect of seed enhancement techniques on growth parameters in onion

Treatments	Field emergence (%)	Plant height@ 60 DAS (cm)	Plant height @ 90 DAS (cm)
L_1	83.56 (66.05)	26.69	40.20
L_2	80.22 (63.56)	24.13	38.23
Mean	81.89 (64.78	25.41	39.21
S.Em. ±	0.55	0.22	0.26
C.D.@ 5%	1.63	0.63	0.76
T_1	80.33 (63.64)	23.93	38.25
T_2	79.33 (62.93)	23.24	37.46
T_3	81.83 (64.74)	25.40	38.47
T_4	86.00 (67.99)	29.58	42.56
T_5	84.50 (66.78)	27.94	41.26
T_6	78.10 (61.93)	22.36	37.30
Mean	81.89 (64.78)	25.41	39.21
S.Em. ±	0.96	0.37	0.45
C.D.@ 5%	2.82	1.10	1.32
L_1T_1	82.67 (65.37)	25.86	38.19
L_1T_2	78.67 (62.46)	25.19	37.33
L_1T_3	84.00 (66.39)	26.69	40.63
L_1T_4	86.67 (68.55)	30.30	43.88
L_1T_5	85.00 (67.99)	28.37	42.58
L_1T_6	83.33 (65.87)	23.72	38.57
L_2T_1	77.00 (62.00)	22.00	38.30
L_2T_2	80.00 (63.40)	21.30	37.58
L_2T_3	79.67 (63.17)	24.11	36.30
L_2T_4	85.33 (67.45)	28.85	41.25
L_2T_5	83.00 (65.62)	27.50	39.93
L_2T_6	75.33 (60.19)	21.00	36.02
Mean	81.89 (64.12)	25.41	39.21
S.Em. ±	1.36	0.53	0.64

C.D. @ 5%	3.98	1.56	1.87

L_1- Fresh seed lot L_2- One year old seed lot (cold storage)
T_1- Film coating with Disco Product-I T_2- Film coating with Disco product-II
T_3-Encrusting with Thiram: Mycorrhiza (1:1.2) T_4-Encrusting with Thiram: Genius coat
T_5- Encrusting with Thiram: Nanonutrient (1:1.2) T_6- Control

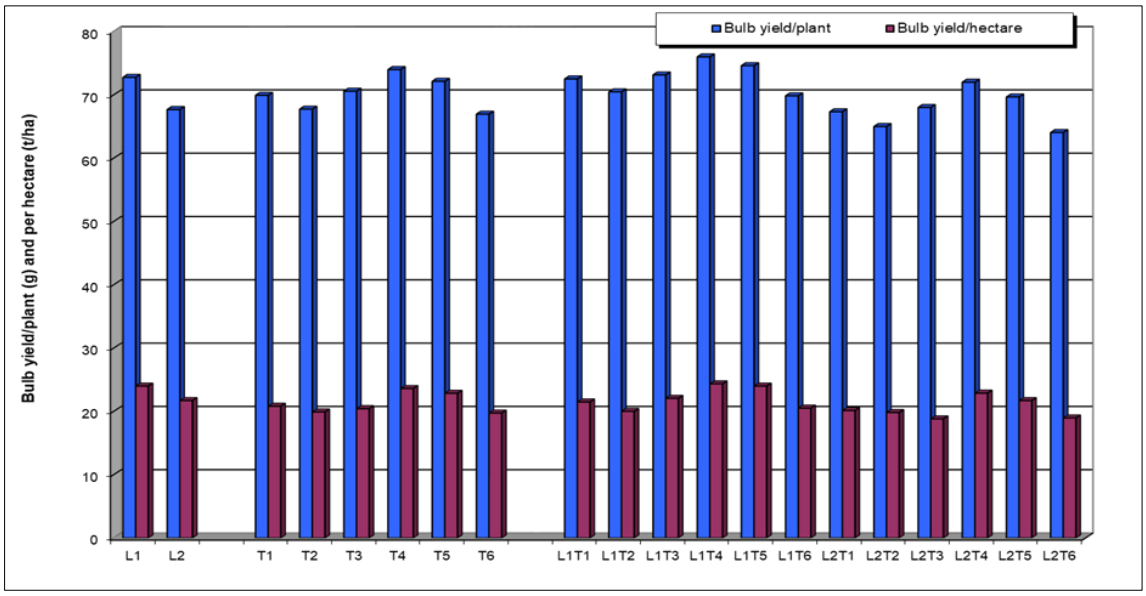

Fig 2: Effect of seed enhancement technique to bulb yield of onion

Table 2: Effect of seed enhancement techniques on yield attributes of onion

Treatments	Weight of bulb (g)	Equatorial diameter (cm)	Polar diameter (cm)
L_1	333.06	5.26	4.70
L_2	321.00	4.83	4.50
Mean	328.53	5.04	4.6
S.Em. ±	3.52	0.03	0.03
C.D. @ 5%	10.32	0.09	0.09
T_1	320.33	4.92	4.47
T_2	312.67	4.89	4.39
T_3	338.50	4.94	4.48
T_4	347.00	5.43	5.03
T_5	343.33	5.40	4.88
T_6	300.33	4.72	4.33
Mean	328.53	5.04	4.60
S.Em. ±	6.09	0.05	0.05
C.D. @ 5%	17.87	0.16	0.15
L_1T_1	323.67	5.20	4.46
L_1T_2	318.33	5.18	4.40
L_1T_3	333.67	5.33	4.66
L_1T_4	350.33	5.48	5.12
L_1T_5	347.00	5.44	5.03
L_1T_6	325.33	4.95	4.52
L_2T_1	317.00	4.63	4.47
L_2T_2	343.33	4.59	4.39
L_2T_3	343.63	4.55	4.31
L_2T_4	343.67	5.38	4.94
L_2T_5	339.67	5.35	4.73
L_2T_6	275.33	4.49	4.15
Mean	328.53	5.04	4.60
S.Em. ±	8.62	0.08	0.07

L_1- Fresh seed lot L_2- One year old seed lot (cold storage)
T_1- Film coating with Disco Product-I T_2- Film coating with Disco product-II
T_3-Encrusting with Thiram: Mycorrhiza (1:1.2) T_4-Encrusting with Thiram: Genius coat(1:1.2)
T_5- Encrusting with Thiram: Nanonutrient (1:1.2) T_6- Control

Conclusion

It can be concluded that encrusting with Thiram: Genius coat (T_4) (1:1.2) has showed better effect in improving field performance in both the fresh and old seed lots over the control by enhancing plant growth parameters and bulb yield of onion.

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