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PHYSIOLOGICAL SEED QUALITY OF ONION CV. PALAM LOHIT AS INFLUENCED BY PELLETING

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ABSTRACT

Over the course of two years (2021–22 and 2022-23), the effect of pelleting on different seed quality characteristics of the onion variety Palam Lohit was studied. Four replications of the experiment were laid out in both laboratory and nursery settings using a Completely Randomized Design (CRD). It consisted of 21 treatments *viz.*, P_1 (Wood ash), P_2 ($ZnSO_4$ + Wood ash), P_3 ($CuSO_4$ + Wood ash), P_4 (H_3BO_3 + Wood ash), P_5 (Bavistin + Wood ash), P_6 (Contaf + Wood ash), P_7 (Captan + Wood ash), P_8 (Turmeric powder + Wood ash), P_9 (*Vitex* leaf powder + Wood ash), P_{10} (Black pepper powder + Wood ash), P_{11} (Clay), P_{12} ($ZnSO_4$ + Clay), P_{13} ($CuSO_4$ + Clay), P_{14} (H_3BO_3 + Clay), P_{15} (Bavistin + Clay), P_{16} (Contaf + Clay), P_{17} (Captan + Clay), P_{18} (Turmeric powder + Clay), P_{19} (*Vitex* leaf powder + Clay), P_{20} (Black pepper powder + Clay) along with P_0 (Unpelleted-Control). Under both laboratory and nursery conditions, it was found that seed pelleting of onion with $ZnSO_4$ + Wood ash (P_2) outperformed all other treatments in terms of various seed quality attributes, including germination (%), seedling length (cm), seedling dry weight (mg), SVI-I and SVI-II.

***Key words*:** Pelleting, wood ash, germination, seedling, nursery.

Introduction

Onion (*Allium cepa* L.) is a primary commercial vegetable. It is a member of the family Alliaceae. It is a cross-pollinated monophyletic monocot that is a cool-season grower and has its roots in Central Asia. It also goes by the name "Queen of the Kitchen". Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana and Telangana are the leading producers of onion in the country. In agriculture, the quality of the seed is even more crucial than the quantity utilized because it affects the pace of seed deterioration and the commercial viability of the crop or variety. Seed treatments, such as seed pelleting, enhance the quality of seeds and increase their effectiveness during the critical stages of germination and seedling establishment.

Pelleting is the process of encasing the seed in a tiny amount of inert material just big enough to create a globular unit of a standard size to aid in precise planting. The inert substance produces an organic water-holding media and provides young seedlings with a tiny amount of nutrients (Roos, 1979). The onion seeds lose their viability very rapidly and are usually very short-lived. They are also quite small in size and have uneven forms, making handling and direct sowing extremely challenging. Pelletizing creates large, smooth-surfaced spheres with spherical shapes from the unusually shaped seeds. Pelleting allows for accurate chemical dosing of seeds, which may improve a number of quality characteristics and ultimately increase seed quality.

Material and Methods

The present investigations were undertaken in the laboratory of the Department of Seed Science and Technology, Dr YS Parmar University of Horticulture and Forestry Nauni, Solan (HP) in 2021. The variety of onion used was Palam Lohit. The experiment was laid out in Completely Randomized Design (CRD) having 8 replications. 50 seeds per replication were tested for

Table 1: Effect of pelleting on seed quality attributes of onion cv. Palam Lohit under laboratory conditions (Pooled mean-2021-22 and 2022-23).

Treatment	Parameters				
	Germination (%)	Seedling length (cm)	Seedling dry weight (mg)	SVI-I	SVI-II
P_0	75.50 (60.37)	8.40	1.93	634.25	145.77
P_1	74.67 (59.91)	11.00	2.08	821.55	155.23
P_2	81.83 (64.86)	12.20	2.48	998.85	203.13
P_3	50.50 (45.29)	7.22	1.83	364.71	92.56
P_4	70.33 (57.11)	10.74	2.00	756.19	140.96
P_5	54.83 (47.78)	9.23	1.92	506.44	105.61
P_6	54.33 (47.79)	8.96	1.94	486.68	105.44
P_7	51.33 (45.77)	9.80	1.94	503.24	99.73
P_8	22.83 (28.50)	9.15	1.74	209.48	40.01
P_9	33.33 (35.25)	8.97	1.86	298.97	62.18
P_{10}	15.67 (23.29)	9.20	1.45	144.33	22.89
P_{11}	11.50 (19.73)	9.50	1.78	109.32	20.64
P_{12}	19.83 (26.30)	9.81	1.90	195.06	37.98
P_{13}	9.33 (17.74)	6.50	0.96	60.84	8.94
P_{14}	16.33 (23.75)	9.71	1.73	158.86	28.54
P_{15}	11.83 (20.09)	9.31	1.66	110.16	19.70
P_{16}	11.33 (19.67)	8.20	1.31	92.97	14.90
P_{17}	16.67 (24.03)	9.37	1.55	156.26	25.89
P_{18}	14.00 (21.94)	7.99	1.15	112.05	16.34
P_{19}	15.50 (23.09)	7.74	1.38	120.16	21.38
P_{20}	13.00 (21.04)	8.50	1.48	110.63	19.40
CD (0.05)	**0.86**	**0.43**	**0.24**	**24.75**	**6.29**

*Figures in parenthesis represent angular transformation

Table 2: Effect of pelleting on seed quality attributes of onion cv. Palam Lohit under nursery conditions (Pooled mean-2021-22 and 2022-23).

Treatment	Parameters				
	Germination (%)	Seedling length (cm)	Seedling dry weight (mg)	SVI-I	SVI-II
P_0	64.29 (53.32)	14.34	1.21	921.82	78.03
P_1	70.05 (56.83)	15.05	2.63	1054.34	184.20
P_2	76.98 (61.35)	16.17	2.90	1245.23	223.16
P_3	47.41 (43.52)	11.46	1.90	543.32	90.23
P_4	65.48 (54.02)	14.93	2.45	977.92	160.50
P_5	61.91 (51.91)	13.53	1.82	837.91	112.90
P_6	52.31 (46.33)	12.93	1.67	676.58	87.43
P_7	47.30 (43.45)	13.18	1.55	623.86	73.43
P_8	23.89 (29.13)	12.60	1.40	302.26	33.87
P_9	27.89 (31.84)	13.13	1.11	366.09	30.83
P_{10}	16.33 (23.64)	11.41	1.41	187.29	23.49
P_{11}	12.82 (20.63)	12.00	1.74	155.06	22.86
P_{12}	17.04 (24.24)	12.68	2.27	216.64	38.79
P_{13}	4.62 (12.38)	10.42	1.05	48.13	4.86
P_{14}	15.40 (22.90)	12.58	1.84	193.98	28.91
P_{15}	11.98 (19.95)	11.63	1.27	140.10	15.63
P_{16}	11.65 (19.75)	11.55	1.62	135.50	19.14
P_{17}	11.45 (19.73)	11.58	1.80	132.79	20.76
P_{18}	11.44 (19.27)	11.47	1.89	131.33	21.91
P_{19}	11.60 (19.76)	11.45	1.25	132.61	14.23
P_{20}	9.09 (17.54)	10.90	1.34	99.27	12.22
CD (0.05)	**2.51**	**0.36**	**0.15**	**44.09**	**7.52**

*Figures in parenthesis represent angular transformation

various quality attributes by sowing the seeds in pro trays. There were total 21 replications in the experiment, namely, P_1 (Wood ash), P_2 ($ZnSO_4$ + Wood ash), P_3 ($CuSO_4$ + Wood ash), P_4 (H_3BO_3 + Wood ash), P_5 (Bavistin + Wood ash), P_6 (Contaf + Wood ash), P_7 (Captan + Wood ash), P_8 (Turmeric powder + Wood ash), P_9 (*Vitex* leaf powder + Wood ash), P_{10} (Black pepper powder + Wood ash), P_{11} (Clay), P_{12} ($ZnSO_4$ + Clay), P_{13} ($CuSO_4$ + Clay), P_{14} (H_3BO_3 + Clay), P_{15} (Bavistin + Clay), P_{16} (Contaf + Clay), P_{17} (Captan + Clay), P_{18} (Turmeric powder + Clay), P_{19} (*Vitex* leaf powder + Clay), P_{20} (Black pepper powder + Clay) along with P_0 (Unpelleted-Control). The filler materials (Wood ash and clay) were used @ 3000 g/kg of seeds. Micronutrients ($ZnSO_4$, $CuSO_4$ and H_3BO_3) were used @ 300 mg kg^{-1} of seeds, fungicides (Bavistin, Contaf and Captan) were used @ 2 mg kg^{-1} of seeds and botanicals (Turmeric powder, *Vitex* leaf powder and Black pepper powder) were used @ 1500 g kg^{-1} of seeds. Carboxy Methyl Cellulose (CMC) @ 1 per cent was used as adhesive for all the pelleting treatments. The seeds were hand pelleted, dried and then tested for germination and vigour attributes in by sowing them in the germinator for laboratory studies and in pro trays for nursery studies.

Observations recorded

The observations were recorded on germination (%), seedling length (cm), seedling dry weight (mg), SVI-I and SVI-II under laboratory and nursery conditions (pro trays). SVI-I and SVI-II was calculated as per the formula given by Khare and Bhale (2000).

Statistical analysis

All the parameters were statistically analyzed with the standard procedure as suggested by Gomez and Gomez, (1983). The level of significance for different variables was tested at 5 per cent value of significance.

Results and Discussions

The analysis of pooled data in Tables 1 and 2 showed that seed pelleting had a substantial impact on a number

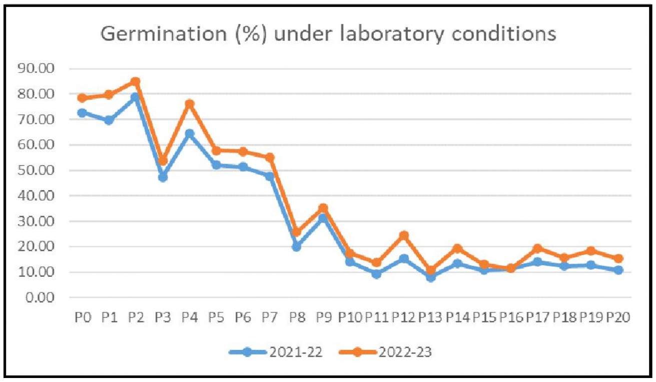

Fig. 1: Graphical representation of Germination (%) as influenced by different seed pelleting treatments under laboratory conditions.

of onion seed quality parameters. Under laboratory circumstances and nursery conditions (pro trays), treatment P_2 ($ZnSO_4$ + Wood ash) had the highest germination rates (81.83 per cent and 76.98 per cent, respectively), which was significantly greater than all the other treatments. Under laboratory and nursery conditions (pro trays), the lowest germination rates (9.33 per cent and 4.62 per cent, respectively) were observed in P_{13} ($CuSO_4$ It is possible that the increased germination brought on by pelleting with wood ash and zinc sulphate is related to zinc sulphate's ability to shield cells from reactive oxygen species damage and retain the structural integrity of the cells (Cackmak, 2000). Additionally, only zinc is a metal that is present in all six categories of enzymes (oxydoreductases, transferases, hydrolases, lyases, isomerases, and ligases). These enzymes are in charge of releasing the seed's food stores, which may have finally caused the seed to germinate (Broadley *et al*., 2007). Since zinc is a component of many proteins, it is also essential for cellular metabolism (Hall, 2002). Additionally, wood ash is a significant source of macro and micronutrients and encourages plant growth. It is also possible that the germination in this instance was

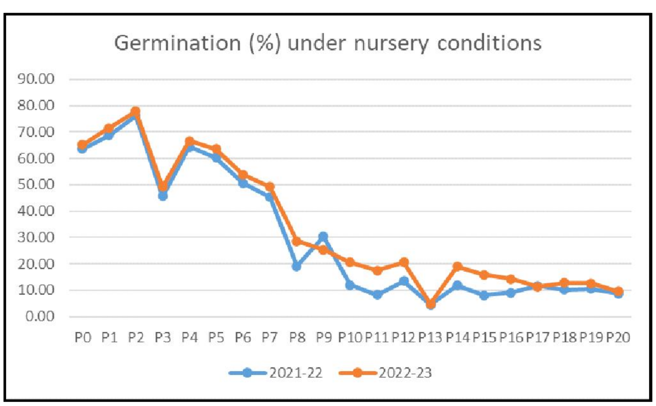

Fig. 2: Graphical representation of Germination (%) as influenced by different seed pelleting treatments under nursery conditions.

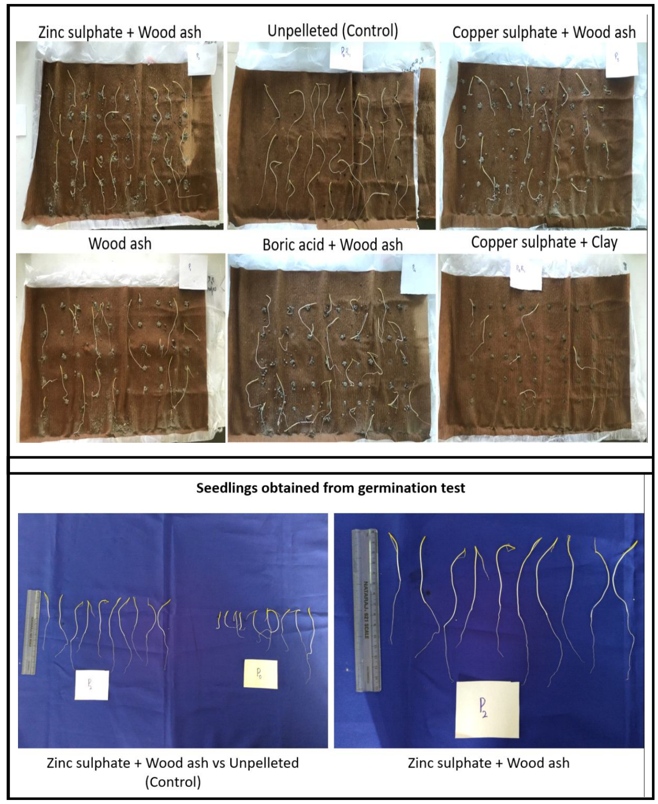

Fig. 3: Germination (%) and seedling length (cm) as observed under laboratory conditions.

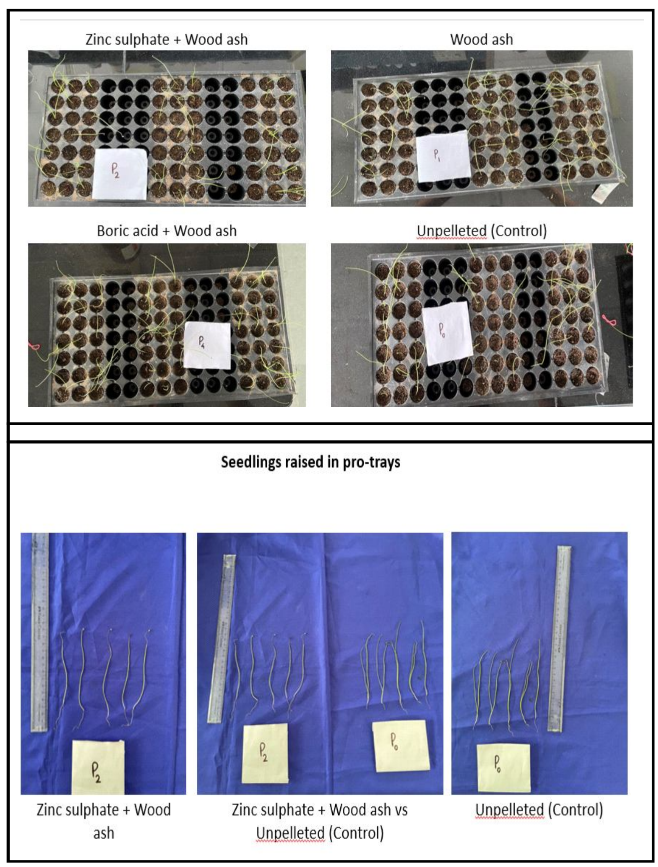

Fig. 4: Germination (%) and seedling length (cm) as observed under nursery conditions.

aided by the softness and ease of breaking of the pellets created utilizing wood ash as the filler material. The aforementioned results are consistent with Swati's (2017) findings, which showed that the onion cv. Nasik Red seed pelleting with $ZnSO_4$ produced the best levels of germination. Additionally, Verma and Mehta (2019) discovered that $ZnSO_4$-pelletized bell pepper seeds greatly outgrew all other treatments, including control, in terms of germination.

Under laboratory and nursery circumstances (pro trays), the treatment P_2 ($ZnSO_4$ + Wood ash) produced the longest seedlings (12.20 cm and 16.17 cm, respectively), while the treatment P_{13} ($CuSO_4$ + Clay) produced the shortest seedlings (6.50 cm and 10.42 cm, respectively). It is possible that zinc enhances the efficiency of nutrient transfer from seed into the initially heterotrophic seedling, which accounts for the highest seedling length in seeds pelleted with zinc sulphate. Also, according to Srinivasan and Naidu, (1986), the endosperm's zinc content may promote the metabolism of auxin, which will increase seedling length. As a rich source of several macro and micro nutrients, wood ash may have encouraged plant growth and led to longer seedlings. This may have contributed to the increase in seedling length. These results are in line with those of Patil *et al.*, (2006), who found that seed pelleting sunflower seeds with $ZnSO_4$ lengthened the roots and shoots of the plant.

Maximum seedling dry weight (2.48 mg and 2.90 mg), which was substantially greater than all other treatments, was reported in P_2 ($ZnSO_4$ + Wood ash), under both circumstances. P_{13} ($CuSO_4$ + Clay) had the lowest seedling dry weight (0.96 mg and 1.05 mg) under both circumstances. The increased seedling dry weight in seeds pelleted with zinc sulphate may be due to the zinc's role in catalytic activity and the breakdown of complicated chemicals into simple forms of glucose, amino acids, and fatty acids, which leads to improved storage of food reserves. Similar to that, wood ash offers macro and micronutrients and might have permitted the seedling to build up more food reserves, increasing seedling dry weight. These findings are in line with those made by Swati (2017), who found that seed pelleting with zinc sulphate improved the seedlings' dry weight in the instance of onions. According to Masuthi *et al.*, (2009), cowpea seeds pelleted with zinc sulphate produced the seedlings with maximum dry weight.

Under laboratory and nursery circumstances (pro trays), the treatment P_2 ($ZnSO_4$ + Wood ash) had the highest seedling vigour index-I values (998.85 and 1245.23, respectively), whereas P_{13} ($CuSO_4$ + Clay) had the lowest values (60.84 and 48.13). The reason why seeds pelleted with $ZnSO_4$ and wood ash had the highest SVI-I may be because of the treatment's maximal effects on seed germination and seedling length, both of which affect the SVI-I for seedling vigour. These results concur with those of Verma and Mehta, (2019), who noted that seed pelleting with $ZnSO_4$ led to greater SVI-I values in the case of bell pepper. Furthermore, Manjunath *et al.*, (2009) noted that seed pelleting with $ZnSO_4$ + captan + imidacloprid enhanced the vigour index of paprika.

Under laboratory and nursery circumstances (pro trays), treatment P_2 ($ZnSO_4$ + Wood ash) had the highest seedling vigour index-II values (203.13 and 223.16, respectively), which was considerably greater than all of the other treatments. In P_{13} ($CuSO_4$ + Clay), the lowest seedling vigour index-II (8.94 and 4.86, respectively) was observed for both conditions. Maximum seedling vigour index-II in seeds pelleted with zinc sulphate and wood ash may be attributed to higher germination and seedling dry weight values in this treatment, which in turn led to an elevated seedling vigour index-II. The findings of the current investigations are consistent with Swati's (2017) observations that onion seed pelleting with $ZnSO_4$ led to improved seedling vigour index-II. Verma and Mehta (2019) also found that pelleting bell pepper seeds with zinc sulphate improved the seedling vigour index-II.

Conclusion

The findings of the present study demonstrated that pelleting with Zinc sulphate and Wood ash improved all the seed quality attributes of onion cv. Palam Lohit under laboratory as well as nursery conditions (pro trays).

Declaration

***Conflict of interest*:** The authors declare no conflict of interest.

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***Data availability*:** Available data is provided in the publication and any other information will be provided on request.

Authors' contribution

I. *Conception or design of the work and final approval of the version to be published*: Dr Manish Kumar and Dr Rohit Verma

II. *Acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important intellectual content*: Dr. Palak Sharma

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