Original Research Article

Effect of organic Seaweed pelleting on seed quality and biochemical parameters in onion seeds

ABSTRACT

Aim: Precision sowing is difficult with small and irregular shaped seeds. Seed pelleting converts such seeds into bold, spherical with smooth surface that helps in easy handling of seeds during sowing.

Study design: The experiment was undertaken with three replications in a completely randomized block design.

Place and Duration of Study: Department of Seed Science and Technology, Agriculture College and Research Institute, TNAU, Madurai, duringthe period of December 2020 and November 2021.

Methodology: Organic seaweed pelleting mixtures can be incorporated effectively that will be useful for ensuring better field emergence and crop establishment and productivity. Seeds were pelleted with different mixtures of *Sargassum* sp., ,*Kappaphycus*sp., *Bacillus subtilis*and Talc powder.

Result: The results reveled that among the treatments seed pelleting with combinations of **T_7**-*Sargassum sp* + *Kappaphycus*sp + *Bacillus subtilis*+ Talc powder was found to be more effective in comparison with other treatments.

Conclusion:Pelleting with *Sargassum*sp, *Kappaphycus*sp, *Bacillus subtilis*and Talc powder was found to be superior in all aspects of seed quality and biochemical parameters.

Keywords: Bacillus subtilis, Onion, Kappaphycussp., Sargassumsp., Pelleting.

UNDER PEER REVIEW

1. INTRODUCTION

Onion (*Allium cepa* L.,) comes under the family of Amaryllidaceae. Onion is aimportant vegetable crop, extensively cultivated in India and other part of Asian countries like Bangladesh, Pakistan and Philippines. The major onion producing countries are China, Turkey, Japan, Egypt, Indonesia, Iraq, Italy, Syria and Spain. India contributes 24 million tons to the global production of onion and ranks second after China with an area of7.80 Lakh hectares (NHB, 2020). In India, major onionproducing states are Maharashtra, Madhya Pradesh, Karnataka, Rajasthan, Bihar, Gujarat, Andhra Pradesh, Haryana, West Bengal and Uttar Pradesh.

Onionseed is small in size and it is not suited for mechanical sowing and therefore the size of the seeds has to be increased by seed pelleting. Among seed enhancement techniques seed pelleting is one of the treatment in which the seeds are coated with suitable chemicals/ botanicals /micronutrients and biocontrol agents with the help of adhesive which will increase the required seed size. Pelleting is mostly practiced in small and irregular shaped seeds for easy handling and helps in mechanized sowing (Halmer, 2003 and Rajeswari*et al.*, 2020).

Seed pelleting is the process of enclosing a seed with small quantities of inert material just large enough to produce globular unit of standard size to facilitate precision planting. The inert material creates natural water holding media and provides a small amount of nutrients to young seedlings (Krishnasamy, 2003). Pelleting of seed with adhesive, fillers and bioactive chemicals focuses on the performance of the seeds. This helps in the achievement of desired population, which is the key basis for successful crop/seed production. Seed pelleting with botanicals (or) organics are the cheapest and non-toxic and provide protection from pests and diseases during germination and early crop growth (Kavitha*et al*., 2009). Seeds pelleted with nutrients improve the initial growth and emergence of the seedling (Roos 1979). Organic pellets are characterized by a greater ability to absorb water than mineral or organic-mineral pellets. Hence present investigation was conducted

UNDER PEER REVIEW

to find out the suitable low cost organic pelleting materials and to standardize and optimize the techniques of seaweed pelleting mixtures and its effect on seed quality in onionseeds.

2. MATERIALS AND METHODS

Genetically pure seeds of Onion (*Allium cepa* L.,)CO (On) 5 obtained from the Department of Vegetable crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulamwas used as base material and the experiment was carried out in the Department of Seed Science and Technology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during 2021. During pelleting the seeds were spread in a thin layer and sprayed with adhesive (4%) over the seeds. Wet seeds were transformed to a container and measured quantity of pelleting mixture was added. Seeds were pelleted with along the following treatments viz., T_0- Control (unpelleted seeds), T_1- Talc powderT_2 - *Bacillus subtilis*, T_3 - *Bacillus subtilis* + Talc powder, T_4 - *Sargassum*sp + Talc powder, T_5 - *Kappaphycus*sp + Talc powder, T_6 - *Sargassum*sp + *Kappaphycus* sp + Talc powder, T_7- *Sargassum sp* + *Kappaphycus*sp + *Bacillus subtilis* + Talc powder. The experiment was undertaken with three replications in a completely randomized block design and evaluated for germination (ISTA 2013), shoot length (cm), root length (cm), dry matter production 10 per seedlings (g), vigour index values (Abdul-Baki and Anderson 1973). The other parameters were evaluated after removing the pelleted material. The electrical conductivity was measured in duplicate with little modification of Presley (1958) by soaking 25 seeds in 50ml water for a duration of 20hand expressed as dSm^{-1}. After measuring the EC, the seed leachate was used for the assessing Leachate sugars ($\mu g\ g^{-1}$) according to Somogyi, (1952) with minor modifications and Leachate free amino acids ($\mu g\ g^{-1}$) estimated in duplicate following the method described by Moore and Stein, (1948) with minor modifications. Dehydrogenase activity (Kittock and law 1968), catalaseactivity (Luck 1974), and antioxidant activity (Blois 1958) were also assessed.

3. RESULTS AND DISCUSSION

UNDER PEER REVIEW

Among the treatments seeds pelleted with *Sargassum sp* + *Kappaphycus*sp + *Bacillus subtilis* + Talc powder recorded higher germination (86%) Seedling length (17.43 cm), dry matter production (0.036g/10 seedlings) andvigour index I (1499), compared to other treatments. Unpelleted seeds recorded the lowest germination percentage (76%), Seedling length (14.86cm), dry matter production (0.022g/10 seedlings) andvigour index I (1129)(Table 1). Coating with seaweeds enhanced the physiological quality parameters. Seaweeds are rich in growth promoting substances (Sylvia *et al.,* 2005) such as IAA, kinetin, zeatin and gibberellins (Zodape*et al.,* 2010) auxins and cytokinins (Zhang and Ervin, 2004); metabolic enhancers; macro and micro elements (Strik*et al.,* 2003) may be enhanced the seed quality parameters.Biofertilizers improve the root development, vegetative growth and nitrogen fixation. They liberate growth promoting substances and vitamins and help to maintain soil fertility and also improve physical properties of soil, soil health in general and help in the bio-control of disease (Iswariya*et al*., 2019). Suma*et al*., 2014 found out that seed pelleting with *Bacillus subtilis* have shown higher seedling characters compared to control in *Sesamum indicum*. Seeds pelleted with *Sargassum sp* + *Kappaphycus*sp+ *Bacillus subtilis*+ Talc powderrecorded lowest EC (0.273dSm^{-1}), leachate sugars (23.80μg g^{-1}) and leachate free amino acids (37.90μg g^{-1}) compared to other treatments (Table 2). The highest dehydrogenase (0.072), peroxidise (1.37) and catalase activities (1.49 µmol of H_2O_2 min^{-1} gram^{-1}) observed in T_7 treatment. The unpelleted seeds recorded higher EC (0.294dSm^{-1}), leachate sugars (28.65μg g^{-1}) and leachate free amino acids (42.25μg g^{-1}).The electrical conductivity of seed leachate was low in pelleted seed. The results were in conformity with the findings ofSujatha (2006) in blackgram, redgram and cowpea and Vethanayagi*et al.,* (2009) in bhendi. Unpelleted seeds also have recorded the lowest dehydrogenase (0.060), peroxidise (1.24) and catalase activities (1.42 µmol of H_2O_2 min^{-1} gram^{-1}). Antioxidant is the collective name for the vitamins, minerals, carotenoids and polyphenols that prevent the harmful effect of free radicals. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions by being oxidized themselves and increased the performance of seeds (Butkhup and Samappito, 2011).

UNDER PEER REVIEW

Analysis of DPPH free radical scavenging activity of seaweeds treated seeds revealed that higher antioxidant property. Peroxidase plays a viable role in seed quality determination as it acts as a protectant against accumulation of peroxides and causes the decomposition of hydrogen peroxide into water and oxygen (Zhang and Khfirkhan, 1994).Pelleted seedrecorded higher dehydrogenase & peroxidase and lower value of free amino acids, sugar and electrical conductivity. Seed pelleted with *Sargassum* sp+ *Kappaphycus*sp + *Bacillus subtilis*+ Talc powderrecorded higher seed quality as well as biochemical parameters viz., dehydrogenase, peroxidise, catalase, and lowers values of EC, leachate free amino acids and leachate free sugars.

UNDER PEER REVIEW

Table 1. Effect of pelleting treatments on physiological quality of onion

Treatment Details	Germination (%)	Seedling length (cm)	DMP (mg/10seedlings)	Vigour index I
T_0	76(66.67)	14.86	0.022	1129
T_1	76(66.67)	14.97	0.023	1138
T_2	80(63.44)	15.67	0.026	1254
T_3	78(62.03)	15.15	0.025	1182
T_4	83(65.65)	16.30	0.030	1353
T_5	81(64.16)	15.88	0.029	1286
T_6	84(66.42)	16.87	0.033	1417
T_7	86(68.03)	17.43	0.036	1499
Mean	**81(64.16)**	**15.89**	**0.028**	**1282**
SEd	1.625	0.376	0.0008	25.004
CD (0.05)	3.444**	0.796**	0.0016**	53.007**

(Figures in parentheses indicate arc sine value)

NS - Non Significant ** - Highly Significant

T_0 – Control T_1 - Talc powder T_2 – *Bacillus subtilis* T_3 - *Bacillus subtilis* + Talc powder

T_4 - *Sargassum*sp + Talc powder T_5 - *Kappaphycus*sp + Talc powder

T_6 - *Sargassum*sp + *Kappaphycus* sp + Talc powder

T_7- *Sargassum* sp + *Kappaphycus*sp + *Bacillus subtilis* + Talc powder

UNDER PEER REVIEW

Table 2. Effect of different pelleting treatments on biochemical parameters of onion

Treatment Details	Dehydrogenase (OD value)	Peroxidase (units/gram)	Catalase (units/gram)	Electrical conductivity (ds/m)	Leachate free amino acids (µg/g)	Leachate free sugars (µg/g)
T_0	0.060	1.24	1.42	0.294	42.25	28.65
T_1	0.060	1.25	1.42	0.290	42.10	28.10
T_2	0.063	1.29	1.44	0.283	40.65	26.80
T_3	0.061	1.27	1.43	0.287	41.22	27.50
T_4	0.067	1.33	1.46	0.278	39.18	25.24
T_5	0.066	1.32	1.45	0.281	39.85	26.11
T_6	0.069	1.35	1.47	0.275	38.74	24.43
T_7	0.072	1.37	1.49	0.273	37.90	23.80
Mean	**0.065**	**1.30**	**1.45**	**0.283**	**40.24**	**36.33**
SEd	0.001	0.028	0.033	0.004	0.746	0.418
CD (0.05)	0.002**	0.060**	0.071*	0.009**	1.582**	0.887**

NS - Non Significant ** - Highly Significant

T_0 – Control T_1 - Talc powder T_2 – *Bacillus subtilis* T_3 - *Bacillus subtilis* + Talc powder

T_4 - *Sargassum*sp + Talc powder T_5 - *Kappaphycus*sp + Talc powder

T_6 - *Sargassum*sp + *Kappaphycus* sp + Talc powder

T_7- *Sargassum* sp + *Kappaphycus*sp + *Bacillus subtilis* + Talc powder

UNDER PEER REVIEW

4. CONCLUSION

It could be conclucded that combinations of pelleting with *Sargassum*sp, *Kappaphycus*sp, *Bacillus subtilis*and Talc powder was found to be superior in all terms of seed quality and biochemical parameters.

CONSENT

Not applicable.

ETHICAL APPROVAL

Not applicable.

UNDER PEER REVIEW

REFERENCES

Abdul-Baki, A. A. and J. D. Anderson. Vigour determination in soybean seed by multiple criteria. Crop Sci., 1973;13: 630-633.

Ambika, S., &Sujatha, K. Organic seaweed nano powder effect on growth and yield attributes of pigeonpea. Legume Research,2016; 40(4), 731-734.

Balaji, D. S., and G. SathityaNarayana. "Effect of various bio priming seed enhancement treatment on seed quality in certain minor millets." *Plant Archives* 19.1 (2019): 1727-1732.

Bharathi, A., P. Nateshan, K. Vanangamudi, P. S. Sherin, M. Ramya and P. Thangavelu. Conceptual and utility differences among seed enhancement technologies viz., seed pelleting, seed coating and seed coloring. ICAR short course on seed hardening and pelleting technologies for rainfed/garden land ecosystems. Tamil Nadu Agricultural University, Coimbatore,2003; p. 131.

Blunden, G. Agricultural uses of seaweeds and seaweed extracts. In: Seaweed resources in Europe: Uses and potential. M. D.Guiry and G. Bluden (eds). Wiley, Chicester.1994; pp: 65- 81

Butkhup, L. and S. Samappito. In vitro free radical scavenging and antimicrobial activity of some selected thai medicinal plants. Res. J. Med. Plant., 2011;5:254 – 265.

Chen, Zijun. "Effects of biochar-based seed coating binders on seed germination and radicle extension."(2021)

Halmer, P. Enhancing seed performance for better yield and quality. Asian Seeds Plant Mater. 2003;10: 4-7.

ISTA. "International Rules for Seed Testing, Rules." International Seed Testing Association. Zurich,ISTA Secretariat.2013

Iswariya, S., K. Sujatha and Subhashini, R. Enhancement of Seedling Vigour through Bio-priming for Barnyard Millet Var. MDU 1. Int.J.Curr.Microbiol.App.Sci. 2019;8(04): 2254-2259.

Kavitha, M.; Deshpande, V.K.; Vyakaranahal, B.S.; Awakkanavar, J.S.; Yashoda, H. and Mathad, J.C. Seed pelleting with organic and inorganic inputs for vigour and viability in chilli seeds. Karnataka J. Agric. Sci. 2009;22(2): 15-19

Kittock, D. L. and A. G. Law. Relationship of seedling vigour, respiration and tetrazolium chloride reduction by germination of wheat seeds. Agron. J.,1968; 60: 286-288.

Krishnasamy, V. "Seed pelleting principles and practices." *ICAR short course on seed hardening pelleting technologies for rainfed/garden land ecosystems,* May 27,2003

Luck, H. Assay of catalase. In: Methods in Enzymatic Analysis 2 (Ed Bermeyer), Academic Press, New York: 1974;Pp. 885.

UNDER PEER REVIEW

Moore, S. and W. H. Stein. Photochromic ninhydrin method for use in chromatography of amino acids. J. Biol. Chem.,1948; 176: 367-388.

Presley, J.T. "Relationship of protoplast permeability of cotton seed viability and predisposition of seedling disease. ." Pl. Dis. Reptr., 1958;42 (7):582.

Rathore, S.S., D. R. Chaudhary, G.N. Boricha, A. Ghosh, B.P. Bhatt, S.T. Zodape and J.S. Patolia. Effect of seaweed extract on the growth, yield and quality of soybean (*Glycine max*) under rain fed conditions. South African Journal of Botany, 2009;75: 351-355.

Roos, E.E. "Storage behavior of pelleted, tableted and taped lettuce seed." *ROOS*.1979.

Saletnik, B., Bajcar, M., Zaguła, G., Saletnik, A., Tarapatskyy, M., &Puchalski, C. biochar as a stimulator for germination capacity in seeds of Virginia mallow (Sidahermaphrodita (L.) Rusby). *Applied Sciences*, 2019; *9*(16), 3213.

Shashibhaskar MS. Influence of seed pelleting on field performance and storability of tomato (Lycopersiconesculentum Mill.) cv. PKM-1. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad; 2008.

Somogyi, M. Notes on Sugar Determintion. J. Biol. Chem., 1952; 200: 245-247.

Strik, W. A., M. S. Novak and J. Van Staden. Cytokinins in macroalgae. Plant Growth Regul., 2003; 41: 13 - 24.

Sujatha, K., G. Vethanayagi and K. Ramamoorthy. Studies on the effect of seaweed extracts on storage potential in bhendi seeds. Seaweed Res. Utiln., 2011; 33(1&2): 125-131.

Suma, N. Studies of seed quality enhancement techniques in sesamum (Sesamumindicum L.) cv. Co-1 in sesamum. M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, 2005.

UNDER PEER REVIEW

Sylvia, S., M. Baluswami, M. D. VijayaParthaSarathy and V. Krishnamurthy. Effectof liquid seaweed fertilizers extracted from *Gracilariaedulis*, Silva, *Sargassumwightii*and*Ulvalactuca*on the growth and yield of *Abelmoschusesculentus*. Indian Hydrobiology, 2005; 7: 69- 88.

Zhang, X. and E. H. Ervin. Cytokinin-containing seaweed and humic acid extracts associated with creeping bentgrass leaf cytokinins and drought resistance. Crop Sci., 2004; 44: 1737- 1745.

Zodape, S., S. Mukhopadhyay, K. Eswaran, M. Reddy, and J. Chikara. "Enhanced yield and nutritional quality in green gram (Phaseolus radiata L) treated with seaweed (Kappaphycus alvarezii) extract." *Crop science*.2010.

UNDER PEER REVIEW