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STUDIES ON PRESOWING SEED TREATMENT FOR SEED PRODUCTION UNDER ABIOTIC STRESS CONDITION IN SESAME (*SESAMUM INDICUM* L.)

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Abstract

Sesame (*Sesamum indicum* L.) is an economically important oilseed crop of the Pedaliaceae family. It is widely cultivated in many parts of the world and is widely used in food nutraceutical and pharmaceutical industries in many countries because of its high oil protein and antioxidant contents. The present investigations were carried out at the Seed Technology Laboratory of the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University to study the effect of seed hardening and pelleting on seed yield of sesame cv VRI 1. The seeds of sesame were hardened with 2% KH_2PO_4 followed by pelleting with fly ash @ 200g/kg, halo polymer @ 2g/kg, DAP @ 60g/kg, $ZnSO_4$ @ 4g/kg, gypsum @ 3g/kg and $MnSO_4$ @ 4g/kg of seed along with control. Better field performance was observed through rate of field emergence, field emergence percentage and seed yield in seeds hardened and pelleted with halo polymer (**T_2**) when compared to other pelleted and unpelleted seeds (control). Hence, it could be concluded that, sesame seeds cv VRI 1 hardened with 2% KH_2PO_4 and pelleted with halo polymer @ 2g/kg of seed showed higher seed yield.

Key words : Sesame, KH_2PO_4, $ZnSO_4$, seed hardening, seed pelleting, halo polymer.

Introduction

Sesame is one of the world's oldest oilseed crop. It is the sixth most important oilseed crop grown in India on an area of 2.9 m. ha with a productivity of 332 kg/ha. Sesame is widely cultivated in many parts of the world and is widely used in food nutraceutical and pharmaceutical industries in many countries because of its high oil protein and antioxidant contents. Yield in sesame needs to be augmented as the productivity in India is very low when compared to other sesame growing countries (Sumathi and Muralidharan, 2009). India ranks first in the world in area (about 2.47 m ha annually, 40% of the world) and production (0.74 m tonnes, 27% of the world) of sesame (Bisht *et al*., 1998). The crop has early origins in East Africa and in India (Nayar and Mehra, 1970; Bedigian, 2003). Today, India and China are the world's largest producers of sesame (Toan Due Pham *et al*., 2010).

Pre sowing hardening or imbibition and drying back of seeds is one of the methods which results in modifying the physiological and biological nature of seed so as to get the characters that are favorable for drought resistance. Seed pelleting is the most applicable technique in direct sown crops which need initial vigour for sustained crop growth and development. Coating provides an opportunity to package effective quantities of material such that they can influence micro environment of each seed which supplies not only micro and macro nutrients but also protects the crop from pests and disease from the earlier stages to the inclusion of pesticides. Because of increased awareness of organic farming, use of plant products in agricultural research is gaining importance. Seed pelleting is an important area in seed production but the rate of adoption of these technologies by the farmers remains notably low and is still insufficient to have real impact on rainfed cultivation. By keeping afore said in view, the study was carried out to study the effect of seed hardening and seed pelleting on seed quality parameters and yield attributes.

Materials and Methods

Genetically pure seeds of sesame (*Sesamum indicum* L) cv VRI-1 obtained from the Regional Research Station, Tamil Nadu Agricultural University, Virudhachalam formed the basic material for this study. The experiment was carried out in the Seed Technology Laboratory and Plant Breeding Farm of Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University. Cleaned and well dried one kg sesame seeds were taken for seed hardening purpose. The seeds were initially soaked in 2% KH_2PO_4 solution for 12 hours. Then the seeds were shade dried for 48 hours before subjected to pelleting. The hardened seeds were pelleted with the following seed treatments.

Treatment details

$\mathbf{T_0}$ - Control

$\mathbf{T_1}$ - Seed pelleting with Fly ash @ 200 g/kg

$\mathbf{T_2}$ - Seed pelleting with Halo polymer @ 2 g/kg

$\mathbf{T_3}$ - Seed pelleting with DAP @ 60 g/kg

$\mathbf{T_4}$ - Seed pelleting with $ZnSO_4$ @ 4 g/kg

$\mathbf{T_5}$ - Seed pelleting with Gypsum @ 3 g/kg

$\mathbf{T_6}$ - Seed pelleting with $MnSO_4$ @ 4g/kg.

In pelleting treatments, the seeds were mixed thoroughly with the rice gruel and uniformly rolled with the various doses of pelleting materials. Then the pelleted seeds were shade dried to bring it to the original moisture content. The treated seeds along with control ($\mathbf{T_0}$) were evaluated for the seed production potential in the Plant Breeding Farm of Department of Genetics and Plant Breeding. The treated seeds along with control were sown in the experimental design of Randomized Block Design (RBD) with three replications. The recommended cultural and plant protection measures were followed uniformly for all the treatment. Ten plants in each treatment were selected at random for recording yield and yield attributing characters. The statistical analysis of data was done by adopting the standard procedures of Panse and Sukhatme (1985). The critical difference was worked out for 5 per cent (0.05) probability.

Results and Discussion

Establishment of seedling in the soil is an important and foremost need for better crop production. This depends largely on the germination and vigour potential of seeds used for sowing. To achieve the goal, holistic approach such as adaptation of sound and proven seed technology, scientific management practices on seed production and supply of good quality seeds for achieving higher productivity. Sesame suffers from severe moisture stress at one or several stages of its growth because of inadequate and uneven distribution of rainfall during the crop season. Its low productivity could be attributed broadly to use of poor quality seeds, soil moisture stress, low and erratic rainfall and improper crop management. To overcome these, new seed management technologies have been developed. One such technology is the seed hardening treatment, which confer reasonable degree of drought tolerance in the initial phase of seed germination. An array of chemical treatments has been found useful for seed hardening in Sesame. However, the practice of hardening seed prior to sowing has not been adopted by our growers. Should it be the ignorance of farmers or inaccessibility and expensive nature of the chemicals recommended for the process is a matter of concern. It is also not clearly known to what extend the beneficial effect of seed hardening is carried forward to higher productivity in sesame. In an effect to provide a self-sustaining seed unit for germination and growth, Seed pelleting enables application of needed inputs such as organic, inorganic nutrient, bio-fertilizer and fungicides on seed itself. Seed pelleting after scope for incorporating organic or chemical substance into seed for improving germination, vigour and controlling micro environment in which the seed germinate. Seed pelleting is relevant for direct sown crops which improves initial vigour, sustained crop growth and development to overcome adverse situation.

Significant results for field emergence were obtained for the seeds hardened with KH_2PO_4 and pelleted with different treatment. Among the different treatments, seed hardening with KH_2PO_4 and pelleted with halo polymer recorded high rate of field emergence $\mathbf{T_2}$ (29) followed by $\mathbf{T_5}$ (27) while the rate of field emergence in control ($\mathbf{T_0}$) was (12). Similar findings were made by Nguyen Hun Hung (2006) in sunflower that the seeds invigorated with 2% KH_2PO_4 for 6 hours showed better establishment and growth characters (table 1).

Field emergence percentage also more for seed treatment with halo polymer ($\mathbf{T_2}$) (89%) followed by $\mathbf{T_5}$ (85%). All the treatments, except fly ash and control recorded eligible certification standard of 65% for sesame, apart from hardening. This may be due to the pelleting materials which help in absorbing and regulating the soil moisture and to enhance the better seed soil relationship under stress condition (Geetha *et al.*, 2007) beside protein synthesis and carbohydrates trace which might have been contributed for increasing germination.

Significant result was obtained for number of leaves per plant, leaf area index and dry matter production.

Table 1 : Effect of seed hardening and pelleting treatment on growth parameters in sesame cv. VRI 1.

Treatments	Rate of field emergence	Field emergence percentage	Plant height (cm)	Number of branches	Number of leaves	Leaf area index
T_0 - Control	12.00	65.00	81.30	2.33	96.33	566.03
T_1 - Flyash @ 200g/kg	16.00	70.00*	124.43*	7.00*	154.33*	1226.17*
T_2 - Halopolymer @ 2g/kg	29.00*	89.00*	125.83*	7.33*	164.66*	1371.73*
T_3 - DAP @ 60g/kg	19.00	79.00*	106.66	4.00	121.66	660.73
T_4 - $ZnSO_4$ @ 4g/kg	16.00	76.00	118.80	6.33	157.67*	844.23
T_5 - Gypsum @ 3g/kg	27.00*	85.00*	114.13	4.33	133.33	772.90
T_6 - Mn SO_4 @ 4g/kg	25.00*	80.00*	117.53*	5.67	145.67*	1161.73
General mean	**20.57**	**77.71**	**112.67**	**5.28**	**139.09**	**943.36**
Cd (P=0.05)	**0.80**	**0.59**	**3.4031**	**1.0941**	**5.4666**	**28.5323**
SEd	**0.37**	**0.27**	**1.6931**	**0.5443**	**2.7197**	**14.1952**

* - Significant.

Table 2 : Effect of seed hardening and pelleting treatment on growth parameters of dry matter production (mg) root length (cm), root volume (mm) and root weight (mg) in sesame cv. VRI 1.

Treatments	Dry matter production (mg)	Root length (cm)	Root volume (mm)	Root weight (mg)
T_0 - Control	15.49	12.33	6.97	0.97
T_1 - Flyash @ 200g / kg	21.86*	22.40*	16.88*	1.43*
T_2 - Halopolymer @ 2g /kg	22.82*	27.23*	17.49*	1.52*
T_3 - DAP @ 60g / kg	16.12	15.66	8.50	1.24
T_4 - ZnSO4 @ 4g /kg	20.82*	18.00	14.19*	1.46*
T_5 - Gypsum @ 3g /kg	18.67	15.66	10.36	1.34
T_6 - Mn SO_4 @ 4g / kg	19.51	23.60	13.69	1.34
General mean	**19.33**	**19.27**	**12.58**	**1.33**
Cd (P=0.05)	**0.7458**	**1.3608**	**0.3810**	**0.0681**
SEd	**0.3710**	**0.6770**	**0.1895**	**0.339**

* - Significant.

Hardened seeds treated with halo polymer (T_2) exhibited more number of leaves (164.66), higher leaf area index (1371.73 cm) and dry matter production (22.82 mg) while the lowest value was observed in control. Increased value in halo polymer (T_2) might be due to the phytotonic effect of the halogen. This finding is in conformity with the result of Prakash and Kalaswamy (2004) and Dhedhi *et al.* (2007) in ground nut (table 2).

The highest plant height (125.83 cm) was observed in seeds treated with halo polymer (T_2) followed by T_1 (124.43) whereas, the lowest plant height of 81.30 cm was observed in control. This might be due to combination effect of seed hardening and pelleting with halo polymer. The seed hardening achieved a number of enzymes for cell mitosis division and elongation (Prakash and Kalaswamy, 2004 in sunflower). Beside this phytotonic effect of halogen treatment also leads to increase in plant height.

Plant growth attributing characters *viz*., root length at the time of harvest, root volume and root weight were also more for the hardened seeds pelleted with halo polymer. This might be due to the combination effect of hardening and pelleting. In hardening, modification of the physicochemical properties of protoplasm which leads to more absorption of water due to increase in the elascity of cell and development of a stronger and efficient root system and phytotonic effect of halogen (table 2).

Highly significant results were obtained for yield parameters *viz*., number of capsules per plant, seed yield

Table 3 : Effect of seed hardening and pelleting treatment on yield parameters of 1000 seed weight (g) and seed yield per plant (g) in sesame cv. VRI 1.

Treatments	1000 seed weight (g)	Seed yield per plant (g)	Number of capsules per plant	Number of seeds per capsule
T_0 - Control	2.28	9.72	66.66	55.66
T_1 - Flyash @ 200g/kg	2.50*	17.61*	114.33*	74.69*
T_2 - Halopolymer @ 2g/kg	2.54*	18.51*	116.33*	76.33*
T_3 - DAP @ 60g / kg	2.46	11.73	75.00	64.33
T_4 - $ZnSO_4$ @ 4g/kg	2.52*	15.73*	114.66*	75.00*
T_5 - Gypsum @ 3g/kg	2.40	13.50	77.00	75.00*
T_6 - Mn SO_4 @ 4g/kg	2.34	16.82*	95.33	73.33
General mean	**2.43**	**14.80**	**94.19**	**70.61**
Cd (P=05)	**0.0739**	**0.3689**	**5.5386**	**4.0702**
SEd	**0.0395**	**0.1835**	**2.7555**	**2.0250**

* -Significant**.**

per plant and thousand seed weight. Higher number of capsules per plant was observed in the seeds hardened with KH_2PO_4 and treated with halo polymer **T_2** (116.33) followed by $ZnSO_4$ (**T_4**) (114.66), while the lowest capsule yield was recorded in control (fig. 1). This is due to the combination effect of seed hardening and pelleting. Similar findings were made by Arjunan and Srinivasan (1999), Dhedhi *et al*. (2007) sesame.

Higher number of seeds per capsule were obtained for the seed treated with halo with polymer **T_2** (76.33) followed by **T_1** (74.69) while minimum was recorded in control. Similar finding were made by Arjunan and Srinivasan (1999) and Srinivasan *et al*. (1999) and Dhedhi *et al*. (2007) in sesame. Maximum 1000 seed weight was registered in the halo polymer treatment (42.54 g) followed by $ZnSO_4$ treatment (2.52 g) and flyash treatment (2.50g). This results were corroborates with the findings of Sathyanaranyaran (2006). Higher seed yield per plant was recorded by the halo polymer treatment **T_2** (18.519g) followed by flyash treatment **T_1** (17.61g) and $MnSO_4$ treatment **T_6** (16.82 g). Similar results were reported by Sathyanarayanan (2006), Sumathi and Muralidharan (2009) in sesame (table 3).

Ranking of various seed treatments based on their mean performance revealed the superiority of the halo polymer treatment (**T_2**) over other seed treatments. The halo polymer treatment recorded superior mean values for almost all the characters studied in the field. It was followed by the flyash seed treatments (**T_1**) and $ZnSO_4$ seed treatment (**T_4**). Four seed treatments namely, **T_1** (flyash), **T_2** (Halo polymer), **T_4** ($ZnSO_4$) and **T_6** ($MnSO_4$) recorded superior mean performances for seed yield per plant, plant height and number of leaves per plant.

Hence, it could be concluded that, sesame seeds cv VRI 1 hardened with 2% KH_2PO_4 and pelleted with halo polymer @ 2g/kg of seed showed higher vigour, viability and seed yield. This could be recommended for the farmers to obtain augmented seed yield.

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