INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

IMPACT OF ORGANIC SEED PELLETING ON SEED GERMINATION AND SEEDLING DEVELOPMENT IN OKRA AND CHILLI PEPPER

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ABSTRACT
The demand for okra (*Abelmoschus esculentus* L.) and chilli (*Capsicum annuum* L.) is greater than the supply and it is necessary to improve productivity and quality of the crops. Laboratory experiments were conducted from September 2014 to January 2015 to determine the influence of seed pelleting with leaves of selected trees on seed attributes and identifying the best leaf pelleting treatment to produce high quality seeds. The experiment consisted of the treatments of leaves from: *Albizzia amara* (T_1), *Cassia auriculata* (T_2), *Peltophorum ferrugineum* (T_3), *Annona squamosa* (T_4), *Pongamia pinnata* (T_5) and *Azadirachta indica* (T_6) compared to untreated seed (T_0). Pelleting treatment affected results. Seed treated with T_4 had improved germination (91.67 and 95.70%), shoot length (6.50 and 8.35 cm), root length (5.00 and 9.55 cm) and vigor index (1054 and 1713.0) in okra and chilli, respectively. Hence, the leaf powders of *Annona squamosa* (T_4) can be commercially utilized for enhancing the seed quality of okra and chilli.

KEYWORDS: attributes, treatment, vegetables.

INTRODUCTION

Chilli (*Capsicum annuum* L.) and okra (*Abelmoschus esculentus* L.) are important vegetables cultivated from the tropics to the temperate zones. Chilli is used in culinary, pharmaceutical and beverage industries throughout the world. Chilli is a rich source of minerals and vitamins A, B and C. Okra green fruit contain significant amounts of protein, carbohydrate, fiber, vitamin C and Ca and is a source of iodine. Supply of quality seeds to producers is essential to successful production of crop. Rapid deterioration of stored vegetable seed is a serious problem which occurs at an increasing rate in uncontrolled storage. The rate of seed deterioration can be reduced by seed treatment, coating, or pelleting with suitable chemicals, botanicals, micronutrients and biocontrol agents which reduce quantitative and qualitative loss and maintain seed quality for longer storage (Shashibhaskar *et al.*, 2009). To promote seedling establishment, minimize yield loss, maintain and improve quality and avoid spread of harmful organisms, seed can be treated with micro- and macro-nutrients, fungicides and insecticides. Seed pelleting with botanicals are cheap and non-toxic and provide protection from pests and diseases during germination and early crop growth (Kavitha *et al*., 2009). Seed pelleting is the process of enclosing a seed with a small quality of inert material to produce a globular unit of standard size to facilitate precision planting. The material creates water holding potential and provides nutrients to young seedlings. It is more beneficial in smaller seed as singling resulting from pelleting helps reduce cost and saves seed (Manjunath *et al.*, 2009). Use of chemicals can be costly and may be hazardous; botanicals are less costly, easily available to farmers, safe to handle and can be easily prepared. Comparative study of botanicals helps to choose those suitable for use (Srimathi *et al*., 2013). Information on seed pelleting in field crops is available but for chilli and okra it is less so. There is a need to develop appropriate seed pelleting technology on development of high quality seed of these important vegetables. The experiment was conducted to study the efficacy of botanical seed pelleting on physiological parameters in chili and okra seed.

MATERIALS & METHODS

Laboratory experiments were conducted in the Department of Seed Science and Technology during 2014. Seed of okra and chilli were obtained from the Department of Vegetables, Tamil Nadu Agricultural University, Coimbatore and the private sector for use in the study. Seed were pelleted with powders made from leaves of: *Albizzia amara*, *Cassia auriculata*, *Peltophorum ferrugineum*, *Annona squamosa*, *Pongamia pinnata*, and *Azadiracta indica* at 300 $g \cdot kg^{-1}$ of seed, using 10% maida as an adhesive (250 to 300 mL kg^{-1}) and dried in shade to reduce moisture content to 9%. Petri dishes (9×1.5 cm dia.) were sterilized using 70% ethanol, washed with distilled water and dried using cotton swabs. Sheets of filter paper were placed in Petri dishes. Twenty surface sterilized (70% ethanol) seed from each crop were placed in each Petri dish. Germination media were prepared with the following the procedure mentioned below. Distilled water was used for the control. The treatments were: control (T0), *Albizzia amara* (T1), *Cassia auriculata* (T2), *Peltophorum ferrugineum* (T3), *Annona squamosa* (T4), *Pongamia pungam* (T_5) and *Azadiracta indica* (T6). The experiment was arranged in a completely randomized factorial design and replicated 3 times. Seed were considered germinated when the radicle was twice the length of the seed. Seed were evaluated for germination percent Germinability was recorded 15 days after sowing (DAS) and numbers of seed germinated expressed as

percent. At 7 DAS seedlings from each replication were carefully removed at random. Shoot length was measured from the collar region to the tip of the longest leaf. Root length was measured from the base of the stem to the tip of the longest root. The seedling vigor index was calculated using the formula of Abdul-Baki and Anderson (1973). Data were analyzed as per Panse and Sukhathme (1999) using the F-test to determine significance among treatments.

RESULTS & DISCUSSION

Pelleting affected germination of both species (Table 1&2). The highest percentage was due to treatment with *Annona squamosa* followed by *Albizzia amara*. The germination percent for other treatments was less. Maximum shoot length was due to treatment with *Annona squamosa* followed by treatments with *Cassia auriculata* and *Peltophorum ferrugineum*. The shortest shoot length was due to treatments with *Albizzia amara* and *Pongamia pinnata*. Treatment affected root length (Table 1). The longest root was due to treatment with *Cassia auriculata* followed by treatments T_4 and T_5 which were similar. The vigor index was affected by treatment with *Annona squamosa* having the highest vigor index followed by treatment with *Cassia auriculata*. Treatments T_1 and T_3 had similar vigor indices.

TABLE 1. Effect of seed pelleting treatments on okra

Treatment	Germination %	Shoot length (cm)	Root length (cm)	Vigor index
Control (T_o)	75.00	3.70	3.50	540.00
Albizzia amara (T_1)	90.00*	3.46	4.00	671.40
Cassia auriculata (T_2)	81.70	4.40	5.13*	778.60*
Peltophorum ferrugineum (T_3)	81.67	4.16	4.00	666.42
Annona squamosa (T_4)	91.67*	6.50*	5.00*	1054.20*
Pongamia pinnata (T_5)	83.00	3.46	5.00*	702.18
Azadirachta indica (T_6)	80.00	3.60	4.00	608.00
Mean	83.29	4.18	4.37	717.25
SD	5.77	1.08	0.65	166.12
SE	0.63	0.53	0.31	6.20
CD	1.27	1.06	0.62	12.40

* Significant at 5% level

TABLE 2. Effect of organic seed pelleting treatments on chilli

Treatment	Germination %	Shoot length (cm)	Root length (cm)	Vigor index
Control (T_o)	78.50	4.25	2.70	388.58
Albizzia amara (T_1)	95.50*	5.30	6.90	1165.10*
Cassia auriculata (T_2)	75.80	5.85	5.50	860.30
Peltophorum ferrugineum (T_3)	92.50*	6.45	6.25	1174.80*
Annona squamosa (T_4)	95.70*	8.35*	9.55*	1713.00*
Pongamia pinnata (T_5)	68.00	8.70*	6.80	1054.00
Azadirachta indica (T_6)	70.00	5.90	7.00	903.00
Mean	82.28	6.40	6.10	1036.96
SD	12.04	1.60	2.68	400.48
SE	1.32	0.63	1.08	12.43
CD	2.65	1.26	2.17	24.87

* Significant at 5% level

The lowest vigor index was for the control. For chillies treatment with *Annona squamosa* produced the highest germination, followed by treatment with *Albizzia amara*. In addition to this treatment T_5 also recorded significant mean values for germination. Treatment affected shoot length with plants from seed treated with *Pongamia pinnata* having the longest shoots followed by treatment with *Annona squamosa*. The shortest shoots were plants developed from control seed. Treatment affected chili root length. Plants developed from seed treated with *Annona squamosa* had the longest roots followed by plants developed from seed treated with T_6. Vigor index was affected by treatment with plants developed from seed treated with *Annona squamosa* having the highest value. Plants developed from seed treated with *Peltophorum ferrugineum* and *Albizzia amara* exhibited high vigor indices; the plants developed from the control seed had the lowest vigor index. There were correlations between seed and plant development attributes (Table 3,4). Positive correlations occurred between germination percent, shoot length, root length and vigor index in okra. There was a significant, and positive, relationship between germination percent and root in okra. There were weak relationships between shoot length and root length and vigour indices. A significant, and positive, correlation occurred between germination and vigor index in chillies. The association between shoot length and vigor index was strong and positive. A weak, and significantly negative relationship, occurred between root length and vigor index in chillies.

It is necessary to maintain a continuous supply of high quality seed to producers, produce genetically pure seed, and preserve seed quality from harvest to next sowing. Only high quality seed can better respond to inputs and management practices. Rapid and uniform field emergence is essential to increase yield, quality and profits in annual crops. Seed pelleting can be used to obtain these goals.

Pre-sowing seed treatments (Sundaralingam *et al*., 2001) claim to have invigorative effects for enhancing yield (Vijayakumar, (1996). Pre-sowing seed management techniques include seed fortification with growth regulators (Chandola *et al*., 1973), nutrients (Venkataraman *et al*., 1978), botanicals (Jegathambal, 1996), pelleting (Balaji, 1990), osmotic priming (Adegbuyi et al., 1981) and seed infusion (Khan *et al*., 2003). Adoption of any of these techniques for a particular crop requires standardization as responses of seed to pre-sowing treatments can vary with concentration and treatment duration. Seed pelleting with *Annona squamosa* maximized seed germination percent, and root length and shoot lengths and vigor index of developing plants. The reason for increase in germination by this botanical is not well known due to a lack of information on the active principle involved. However, these botanicals may contain micro-nutrients conducive for seed invigoration as reported by Sasthri (2010).

TABLE 3. Correlation between germination and seedling development parameters of okra

	Shoot length (cm)	Root length (cm)	Vigor index
Germination %	0.753	0.915*	0.740
Shoot length (cm)		0.463	0.492
Root length (cm)			0.543

* Significant at 5% level

TABLE 4. Correlation between germination and seedling development parameters of chilli

	Shoot length (cm)	Root length (cm)	Vigor index
Germination %	0.593	0.720	0.945*
Shoot length (cm)		0.365	0.741
Root length (cm)			-0.024

* Significant at 5% level

The leaves are also contains gibberellin like substances and zinc, which are synergistically activated to form indole acetic acid (Shkolnik *et al*., 1975). Increased quality parameters in developing plants may be due to enlarged embryos, higher rate of metabolic activity and respiration, better utilization and mobilization of metabolites to growing points and higher activity of enzymes (Satiskumar *et al.,* 2011). The presence of phenols in leaves could have promoted root length. The control had the lowest root length and might be due to low availability of nutrients in the water. The increased shoot length due to seed treatment with tree leaf extracts may be attributed to cell wall extension and increased metabolic activities at low water potential, as in matripriming (Afzal *et al*., 2002). Botanicals contain growth promoting substance and nutrients (Anon, 2000) which could support better seedling performance. The beneficial influence of botanicals in enhancing storability and seed quality was reported by Maraddi (2002), Patil (2000) and Sharma (1995) in other crops. This indicates that the response could be universal across plant types. The majority of leaf powders produced phytostimulatory effects on enhanced seed germination and improved development of seedlings after germination. It is determined from the seed pelleting study, *Annona squamosa* (T4) can be recommended for improving the seed quality and seedling characters of okra and chilli.

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