

Influence Of Seed Pelleting Technique On Seed Germination In Okra (*Abelmoschus Esculentus* L.) Bungoma, Kenya.

ABSTRACT

In Kenya, demand for okra (*Abelmoschus esculentus* L.) vegetable is greater than the supply and it is necessary to improve productivity and quality of the crop. Laboratory experiments and survey study were conducted at Mabanga Agricultural Training Institute in Bungoma County from September 2019 to January 2020 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 treatments of leaves from: *Albizia amara* (T1), *Cassia auriculata* (T2), *Peltophorum ferrugineum* (T3), *Annona squamosa* (T4), *Pongamia pinnata* (T5) and *Azadirachta indica* (T6) compared to untreated seed (T0). Pelleting treatment affected results. Seed treated with T4 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 plant. Leaf powders of *Annona squamosa* (T4) can be commercially utilized for enhancing the seed quality of okra vegetable.

INTRODUCTION

Agriculture is the mainstay of Kenya's economy providing the basis of development for other sectors of the economy. The Agricultural sector contributes about 30% of the gross domestic product and accounts for over 75% of the total labour force (HCDA, 2013). Okra (*Abelmoschus esculentus* L.) is an important vegetable cultivated from the tropics to the temperate zones. Okra green fruit contain significant amounts of protein, carbohydrate, fiber,

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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 (Prasher et al., 2020). 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 (Javed et al., 2021). Seed pelleting is the process of enclosing a seed with a small quantity 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 (Ben-jabeur et al., 2021). Use of chemicals is costly and hazardous; biological control and cultural methods are less costly, easily available to farmers, safe to handle and can be easily prepared. Information on seed pelleting in field crops is available but for okra it is inadequate, there is a need to develop appropriate seed pelleting technology on development of high quality seed of these important vegetables. The experiment was conducted in a laboratory and survey to aid study of seed pelleting on physiological parameters in okra seed.



MATERIALS & METHODS

Laboratory experiments were conducted at Mabanga Agricultural Training & Research Centre in Bungoma Western Kenya, during September 2019 to January 2020 in addition to a survey questionnaire with the help of Assistant chief and village elders to local farmers (ease of communication & interpretation because we were foreign student to public) was included to cement the scientific research appropriately. The area (Bungoma County) was selected for study because vegetable production is a major economic activity in the area due to food culture and markets which serve consumers of diverse socio- economic status. Consequently, the population density is composed of readily available consumers from different backgrounds and social status who have diverse preferences. Certified seeds of Okra were obtained from Kenya seed company agro vet dealer in Mabanga Centre Bungoma

County for use in the study. Seeds were pelleted with powders made from leaves of: Albizzia amara, Cassia auriculata, Peltophorum ferrugineum, Annona squamosa, Pongamia pinnata, and Azadiracta indica at 300 g· kg-1 of seed, using 10% gum arabic as an adhesive (250 to 300 mL kg-1) and dried in shade to reduce moisture content to 9%. Glass petri dishes were surface sterilized using 70% ethanol, washed then rinsed with distilled water and dried using clean cotton swabs. 3 sheets of folded filter papers were placed in glass petri dishes. Fifty seeds were counted using a clean spatula then carefully placed in each Petri dish. Stock solution was prepared (GA3 1 gram+1000 cm3 of distilled water= stock soln). 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 (T5) and Azadiracta indica (T6). The experiment was arranged in a completely randomized factorial design and replicated 3 times. Seeds were considered germinated when the radicle was twice the length of the seed. Seed were evaluated for germination percent more so 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 using GENSTAT Statistical Package F-test to determine significance among treatments.

RESULTS & DISCUSSION

Analysis of variance revealed that there were significant effects of seed pelleting on germination%, Shoot length, Root length and seed vigour index.

Germination (%) was calculated as

per the rules laid out by ISTA 2021 (International Seed Testing Association). Fifty seeds from all replications of each treatment were used for conducting the germination test. This was carried out by using glass petri-dishes covered by

Whatmann filter paper (white) in the seed germinator chamber at 25°C. The first and final counts were taken after 7 and 14 days, respectively.

S ₀	S ₃		S ₆	S ₉		S ₁₂	Mean
	(0 month)	(Sept 2019)	(Oct 2019)	(Nov 2019)	(Dec 2019)		
T ₁	2792.70	2752.03	2571.60	2384.95	2315.58		2563.37
T ₂	2980.48	2947.25	2806.88	2640.38	2558.33		2786.66
T ₃	2834.03	2800.15	2682.68	2599.78	2542.08		2691.74
Mean	2869.07	2833.14	2687.05	2541.70	2471.99		
Factor	T		S		T×S		
SEm±	13.61		17.57		30.45		
CD (p=0.05)	38.67		49.92		86.48		

Germination (%) was calculated by using the formula below.

Germination (%)= Number of normal seedlings ×100 / Total number of seeds.



Table 1: Effect of seed pelleting on Okra seed vigour index.

**Treatments Seed vigour index
Storage duration (Months)**

Socio economic characteristics of consumers are important in product market assessment since it influence consumption patterns of a given commodity (Leach et al., 2020). Table 2 shows the socio economic characteristics of Okra vegetables consumers. The

results indicate that most of the decision making on Okra vegetable purchases are made by women as compared to men. The average age for the Okra consumers in the study area was 24.1 years (Table 2). The youngest consumer was aged 8 years whereas the oldest was aged 41 years

while average retail price per kilogram of Okra leaves in the study area is Ksh.33.65. The maximum price is Ksh. 45 while the minimum price is Ksh.25 per every kilogram of Okra leaves sold.

Table 2. Socio economic characteristics of the sampled households in Mabanga, Bungoma.

Variable	Category	Frequency (N)	Percentage (%)	Min	Max	Mean		
Gender	Male	38	38	-	-	-		
	Female	61	61	-	-	-		
Marital/S	Married	63	64.95	-	-	-		
	Single	20	20.62	-	-	-		
	Widow/er	14	14.43	-	-	-		
Education	No education	9	9.09	-	-	-		
	Primary	13	13.13	-	-	-		
	Secondary	27	27.27	-	-	-		
	Diploma	28	28.28	-	-	-		
	Degree	16	16.16	-	-	-		
	Postgraduate	6	6.06	-	-	-		
Income	<10,000	1	1.03	-	-	-		
	10001-20000	8	8.25	-	-	-		
	20001-30000	12	12.37	-	-	-		
	30001-40000	20	20.62	-	-	-		
	40001-50000	19	19.59	-	-	-		
	50001-60000	17	17.53	-	-	-		
	>60000	9	9.28	-	-	-		
Price per KG of Okra		-	-	25	45			33.65
Age		-	-	8	41			42.21
Household size		-	-	1	12			5.48



Treatment	Germination %	Shoot length (cm)	Root length (cm)	Vigor index
Control (T ₀)	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

Pelleting affected germination of Okra vegetable (Table 3). 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 3). The longest root was due to treatment with Cassia

auriculata followed by treatments T₄ and T₅ 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 T₁ and T₃ had similar vigor indices.

TABLE 3. Effect of seed pelleting treatments on okra

• Significant at 5% level

The lowest vigor index was for the control. The shortest shoots were plants developed from control seed, 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. 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 (Mauro et al., 2021) claim to have invigorative effects for enhancing yield (Afzal et al., 2021). Pre-sowing seed management techniques include seed fortification with growth regulators,

nutrients (Taylor et al., 2020), pelleting (Javed et al., 2021), osmotic priming (Taylor et al., 2020) and seed infusion (Ayenon et al., 2021). 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.

TABLE 4. 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



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. The presence of phenols in leaves could have promoted root length. Control had the lowest root length and might be due to low availability of nutrients in the water, 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 priming (Adrian et al., 2021). This indicates that the response could be universal across plant types. The majority of leaf powders produced phyto-stimulatory effects on enhanced seed germination and improved development of seedlings after germination. It is determined from the seed pelleting study, *Annona squamosa* (T4) is recommended for improving the seed quality and seedling characters of okra.

Conclusion

Seed pelleting technique is found to be a proven method to improve Okra germination. Pelleting of fresh seeds with *Rhizobium* liquid culture improves seed quality parameters considerably, the analysis of variance revealed that there were significant effects of seed pelleting and germination %, shoot length, root length and seed vigour index.



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