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EFFECT OF MEDIA AND HUSKING ON SEEDS GERMINATION OF SOME MANGO CULTIVARS

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Abstract: Many seeds were covered with woody coats that may lead to seedlings poundage into the coat so decrease the seeds germination as well as its damage before its release from the coat. This may lead to loss of a great number of seedlings that can be obtained especially the polyembryonic seeds to produce identical seedling for the same mother plant or the monoembryonic seeds to produce rootstocks for grafting. So this study made a trial on polyembryonic seeds (Hindi Bisinnara, Goleck) and monoembryonic seeds (Pairi, Mabrouka). Half of the seedstones were husked for each treatment. Three media: clay, peatmoss and sawdust wood were used in order to study its effect on percentage and time of germination of seeds. The results showed that:

1 - The highest germination percentage with highly significant difference was in the husked seeds whether it is polyembryonic seeds (Hindi Bisinnara and Goleck) or monoembryonic seeds (Pairi and Mabrouka).

2 - A highly significant difference was found between different media of planting where sawdust has the highest germination value.

3 - After ten days we can obtained the highest germination percentage that were reached to 83.00%, 84.67 with a mean of 83.84% from total seeds which were planted in sawdust with husking in both the polyembryonic and monoembryonic respectively. The germination percentage at the same period was zero in sawdust with unhusked seeds of both polyembryonic and monoembryonic seeds.

4 - Initial selection of seeds and seedling as well as isolation of the obliterated and damaged seeds or week seedling could be done at an early time and thus decreasing its planting coast in plots.

5 - This study led us to the easy detection and separation of nucellar seedlings from the polyembryonic seeds and using it as a source for a similar mother plant. Also, the characterization of strong seedling and its selection as a rootstocks for grafting with easy uprooting without seedling loss. So, root hairs are protected from destruction.

This study recommended the importance of mango seed husking and its planting in sawdust in order to obtain the seedlings within ten days with a mean of 83.84% from the total germination mango seeds whether it is polyembryonic or monoembryonic before its transporting into plots or nursery land.

Introduction

The mango is propagated by sexual and asexual methods. In the sexual method, the propagation is brought about by seeds which are either monoembryonic or polyembryonic in nature. Propagation is the oldest, cheapest, and easiest method known to man. Mango seeds in Egyptian cultivars are used in production of rootstocks for grafting the various desired varieties or cultivars. It is preferable to sow seeds just after their extraction from the ripe fruits, that is because of their poor storage, having no dormancy (Carbineau *et al.*, 1987) and low germination percentage due to late planting (Ito and Atubra, 1974; Chandra, 1981 and Patil *et al.*, 1987). Husking or decortication of the hard endocarp of the seed improves germination, Chauran *et al.* (1979). Abdel-Galil (1992) recommended the use of sawdust and removing the crust for sowing the mango seeds to obtain the highest percentage of germination as well as the least germination rate index. Zygotic and nucellar seedlings, however can often be morphologically similar. Therefore, detection and separation of nucellar seedlings are very important (Litz, 1997). Schnell and Knight (1992) and Degani *et al.* (1993) have demonstrated that isozymes can be used to distinguish zygotic embryos from nuelear seedlings. Polyembryonic cultivars have traditionally been seed-propagated in southeast Asia and tropical Latin American countries. In mango growing areas, polyembryonic and monoembryonic mango selections are grafted onto uniform, nucellar seedling rootstock (Litz, 1997). So this study made a trial on polyembryonic seeds (Hindi Bisinnara, Goleck) and monoembryonic seeds (Pairi, Mabrouka). Three media, clay. peatmoss and sawdust wood were used in order to produce identical seedling for the same mother plant from the polyembryonic seeds and to produce rootstocks for grafting from monoembryonic seeds. This study was carried out to see the effect of husking and media on the percentage and time of germination of mango seeds.

Materials and Methods

This study was carried out during July to September, 1992 and 1993 under room temperature (av 30°c) and 85% relative humidity (R.H.) of pomology laboratory, Faculty of Agriculture, Assiut University The seedstones of the mango (*Mangifera indica* L.) used in this study were four cultivars of both Hindi Bisinnara, Goleck as Polyembryonic seeds and both Pairi, Mabrouka as Monoembryonic seeds.

Three media, i.e., clay, peatmoss and wood sawdust were used for

sowing. Half of the seedstones were husked and the other half were unhusked. Within each media the husked and unhusked seeds were sowed at a rate of 50 seeds per box (replicate). There were three replicates giving a total of 18 boxes. The same design were made within each cultivars.

The seeds were sowed two inches deep in the media for all treatments. The number of germinated seeds were counted every two days, but statistical analysis were done at 10, 18, 24, 30 and 40 days and the germination rate of seeds were calculated by using the following equation according to (Toaima, 1980).

$$\text{Germ. rate index} = \frac{R_1A_1 + R_2A_2 + B_3A_3 + \ldots\ldots \text{etc.}}{\text{Sum } (A_1 + A_2 + A_3 \ldots\ldots)}$$

where: R_1, R_2, R_3 ... number of days of germination.

A_1, A_2, A_3 ... number of germinated seed.

The treated seeds were arranged in a factorial experiment in a completely randomized design (CRD) in three replicates according to (Snedecor and Cochran, 1980). Decortication of seeds were done by removing the hard coat carefully not to cause any damage to the cotyledons and therefore the suture of the hard coat was cut open with a sharp scissors. The germination was recorded as soon as seedling exit from the media.

Results and Discussion

1- Effect of husking of seedstones:

Tables (2, 4, 6, and 8) in 1992 and 1993 seasons shows the over all germination percentage of husking treatment after 18 days of all mango cultivar at this experiment regardless of the sowing media. In 1992 season, the husked seeds gave germination percentage of 81.78 and 76.89% in Hindi Bisinnara and Goleck, respectively (polyembryonic) with a mean of 79.33%, 89.78 and 90.67 in Pairi and Mabrouka, respectively (monoembryonic) with a mean of 90.22%, compared with 13.33 and 18.67 % in Hindi Bisinnara and Goleck, respectively (polyembryonic) with a mean of 16.00%, 22.22 and 24.89% in Pairi and Mabrouka, respectively (monoembryonic) with a mean of 29.55% in unhusked seeds. The mean germination percentage after 18 days was 84.78% in husked seeds compared with 19.78% in unhusked seeds regardless of the type of seeds (poly- or mono-embryonic).

So, the germination percentage of husked seeds after 18 days were more than 4.3 times that of unhusked seeds.

The germination rate of husked seeds were 25.91, 26.59, 25.53 and 25.43 days in Hindi Bisinnara, Goleck, Pairi, Mabrouka, respectively with a mean of 25.87 days. These values were lower than that of unhusked ones which were 31.85, 30.73, 31.07 and 31.18 respectively with a mean of 31.21 days. The results in 1993 season had the same trend.

The best treatment to obtain the highest germination percentage and the lowest germination rate was removing the hard coat of the seed in order to help the seedling to emerge. These results are in agreement with those obtained by Sinnadurai (1976) in some mango cultivars in Ghana and Abdel Galil (1992) in mango seedstones. This hard coat of the seeds may be responsible for the delayed emergency of the seedlings because both of the linner membranous seed coat and the shell could restrict the movement of gases (particularly oxygen and CO_2) to the embryo. This situation has been used to explain the germination control by the dormant embryo of the seeds (Hartmann and Kaster, 1983).

2. The effect of media:

Data concerning the mean germination percentage of mango seeds as affected by clay soil, peatmoss and sawdust media are presented in Tables 1, 3, 5 and 7 as well as Tables 2, 4, 6 and 8. In 1993 season, regardless of seed husking, the mean germination percentage after 10 days were 45.33, 38.00% of polyembryonic and 42.67, 42.00% of monoembryonie seeds in sawdust media, 38.66, 21.33% of polyembryonic and 40.67, 41.33% of monoembryonic seeds in peatmoss whereas in clay soil they were 1.33, 2.00% of polyembryonic, 6.67 and 7.33% of monoembryonic seeds respectively. During 18 till 40 days, the differences in germination percentages were minimized, i e they were 88.67, 87.33% of polyembryonic and 93.33, 96.00% of monoembryonic seeds in sawdust media, 89.33, 86.00% of polyembryonic and 91.33, 94.00% of monoembryonic seeds in peatmoss whereas in clay soil, they were 74.00, 79.33% of polyembryonic and 84.67, 84.67% of monoembryonic seeds, respectively.

The germination rate of sawdust was lower (27.65, 27.67 for polyembryonic and 27.34, 27.51 days for monoembryonic) than that of peatmoss (28.21, 27.94 for polyembryonic, 27.43, 27.55 days for monoembryonie) and clay soil

(30.79, 30.37 for polyembryonic and 30.09, 29.84 days for monoembryonic), respectively.

The results in 1993 season had the same trend. These findings might be due to the many advantages of the sawdust over other media through its porosity that permits areation and probably it is the poorest medium for the growing of mieroorganisms. Thus in turn leads to keeping the dicotyledones in a good state and to supply the embryos with moisture and oxygen requirements. However, it was found from literature that leaf mould was the best of several germination media which also included sand, soil, and sawdust (Teaotia and Singh, 1973). The sawdust medium was the best loose medium for germination as compared with peatmoss or clay soil (Abdel Galil. 1992)

3. The combined effect of husking seedstones and media:

Data presented in the Tables 1, 3, 5 and 7 and Tables 2, 4, 6 and 8 illustrate the combined effect of seed husking and media on the germination percentage of mango seeds In 1992 season, the sawdust medium together with husking seedstones gave 90.66, 76.00% of Hindi Bisinnara and Goleck with a mean of 83.00% for polyembryonic and 85.33, 84.00% of Pairi and Mabrouka with a mean of 84.67 for monoembryonic respectivcly with a total mean of 83.84%, within 10 days as compared with zero germination after the same period in a similar medium but without husking.

After 18, 24, 30, 40 days, the percentage of germination in unhusked seeds and in sawdust media were (13.33, 41.33, 60.00 and 78.87%) in Hindi Bisinnara, (18.67, 48.00, 74.67 and 77.33%) in Goleck, (28.0, 48.0, 82.67 and 88.0%) in Pairi, (30.67, 45.33, 62.67 and 92.00%) in Mabrouka respectively.

These data emphasized the fact that husking has the pronounced effect to hasten germination percentage rather than media used. Similarly, appreciable germination percentage was acquired in peatmoss with husked seeds at 18 days 97.33% as compared to 18.67% in the same period and similar medium but without husking for Hindi Bisinnara as well as 94.67% as eompared to 21.33% for Goleck, 97.33% as compared to 26.67% for Pairi 98.7% as compared 30.67% for Mabrouka. In addition, the highest percentage of germinatiou in clay soil was found after 30 days 85.33, 88.00% for Hindi Bisinnara, Goleck respectively in husked seeds as compared with unhusked seeds which gave only 34.67, 41.33% for Hindi Bisinnara and Goleck respectivcly. In Pairi and Mabrouka they were 90.67, 86.67%, respectively in husked seeds as

compared with 30.67, 38.67% for unhusked seeds after 24 days. In sawdust the germination percentage, after 18 days were 98.67, 97.33% in Hindi Bisinnara, Goleck and 98.67, 100.0% in Pairi and Mabrouka respectively in husked seeds as compared with 13.33, 18.67% in Hindi Bisinnara and Golcek and 28.00, 30.67% in Pairi and Mabrouka, respectivcly for unhusked seeds.

The results 1993 season had the same trcnd. These results might be attributed to the freely supply of oxygen and moisture to the embryos. Oxygen supply is limited when there is excessive water in the soil medium. Good exchange of gases between the germination medium and the embryos are essential for rapid and uniform germination (Hartmann and Kcster, 1983).

4. The effect of cultivar of mango

No differencc was found between polyembryonic seeds and monoembryonic seeds which together gave the highest germination percentage after 18 days in 1992 season They were 98.67, 97.33 in Hindi Bisinnara and Goleck with a mean of 98.00% for polyembryonic and 98.67, 100.00% in Pairi, Mabrouka with a mean of 99.34% for monoembryonic from total seeds which were planted in sawdust with husking, whercas the germination percentage at the same period were 13.33, 18.67% for Hindi Bisinnara, Goleck with a mean of 16.00% for polyembryonic and 28 00, 30.67% in Pairi, Mabrouka with a mean of 29 34% for monoembryonic seed. respectively

After ten days we can obtained the highest germination percentage that were reached to 83.00%, 84.67 with a mean of 83.84% from total seeds whieh were planted m sawdust with husking in both the polyembryonic and monoembryonic respectivcly. The germination percentage at the samc period was zero in sawdust with unhusked seeds of both polycmbryonic and monoembryonic seeds. The results in 1993 season had the same trcnd.

So we notieed that, the use of sawdust and rcmoving the crust for sowing Hindi Bisinnara, Goleck (polyembryonic) and Pairi and Mabrouka (monoemhryonic) seeds is important to obtain the highest percentage of germination as well as the least germination rate index From this study we can benefit the following: 1) We can sct aside thc feeble and injured or destroyed seeds just before sowing by using shell removal technique. 2) Enhancing seedling production from all embryos in the same time and in a similar growth especially for polycmbryonic seeds and separating them during transplanting in the nurscry. 3) We can set asidc the deformed seedlings

Table (1): The mean germination percentage and germination rate in Hindi Bisinnara mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatment		Percentage of germinated seeds in days after																		Germination rate (days)
		4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	
1992																					
Un-	Clay	0.00	0.00	0.00	0.00	0.00	5.33	6.67	8.00	9.33	10.67	12.00	22.67	28.00	34.67	53.33	60.00	62.67	62.67	62.67	32.68
husked	Peat moss	0.00	0.00	0.00	0.00	0.00	9.33	12.00	18.67	24.00	25.33	34.67	34.67	38.67	48.00	64.00	72.00	74.67	81.33	81.33	31.49
seed	Sawdust	0.00	0.00	0.00	0.00	0.00	8.00	10.67	13.33	18.67	26.67	41.38	46.67	53.33	60.00	66.67	70.67	73.33	78.67	78.67	31.38
Husked	Clay	0.00	0.00	0.00	2.67	13.33	17.33	33.33	49.33	54.67	61.33	81.33	85.33	85.33	85.33	85.33	85.33	85.33	85.33	85.33	28.89
seed	Peat moss	0.00	0.00	29.33	77.33	90.67	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	24.93
	Sawdust	0.00	44.00	68.00	90.67	94.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	23.92
1993																					
Un-	Clay	0.00	0.00	0.00	0.00	0.00	6.67	8.00	9.33	9.33	12.00	12.00	18.67	32.00	37.33	56.00	64.00	64.00	64.00	64.00	32.57
husked	Peat moss	0.00	0.00	0.00	0.00	0.00	10.67	12.00	21.33	26.67	28.00	37.33	40.00	41.33	50.67	68.00	73.33	74.67	76.00	76.00	31.34
seed	Sawdust	0.00	0.00	0.00	0.00	0.00	10.67	14.67	17.33	17.33	28.00	40.00	40.00	54.67	60.00	69.33	76.00	76.00	84.00	84.00	31.09
Husked	Clay	0.00	0.00	0.00	4.00	12.00	16.00	32.00	45.33	50.67	62.67	85.33	89.33	89.33	89.33	89.33	89.33	89.33	89.33	89.33	29,10
seed	Peat moss	0.00	0.00	32.00	78.67	93.33	100.0	100.0	100,0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	24 91
	Sawdust	0.00	45.33	70.67	94.67	96.00	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	23.87

Table (2): F-test, L.S.D.$_{0.05}$, mean germination percentage and germination rate in Hindi Bisinnara mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatments		Mean germination percentage of seeds after (days)					Germination rate (days)	Mean germination percentage of seeds after (days)					Germination rate (days)
		10	18	24	30	40		10	18	24	30	40	
		1992						1993					
Unhusked seed		0.00	13.33	29.33	47.56	74.22	31.85	0.00	16.00	29.78	49.33	74.67	31.67
Husked seed		56.89	81.78	92.44	93.78	93.78	25.91	59.11	81.75	96.11	96.44	96.44	25.96
F-test		**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%		1.90	3.80	1.90	8.27	1.90	0.16	3.80	3.29	5.70	6.84	1.90	0.001
Clay		1.33	28.67	46.67	60.00	74.00	30.79	2.00	27.33	48.67	63.33	76.67	30.83
Peat moss		38.66	58.00	66.00	72.67	89.33	28.21	39.33	60.67	68.67	75.33	88.00	28.00
Sawdust		45.33	56.00	70.00	79.33	88.67	27.65	47.33	58.67	70.00	80.00	92.00	27.00
F-test		**	-	**	**	-	**	**	-	**	**	**	**
L.S.D. 5%		2.51	2.94	3.97	4.44	3.55	0.20	1.26	4.86	2.81	2.51	1.26	0.12
Unhusked seed	Clay	0.00	8.00	12.00	34.67	62.67	32.68	0.00	9.33	12.00	37.33	64.00	32.57
	Peat moss	0.00	18.67	34.67	48.00	81.33	31.49	0.00	21.33	37.33	50.67	76.00	31.34
	Sawdust	0.00	13.33	41.33	60.00	78.87	31.38	0.00	17.33	40.00	60.00	84.00	31.09
Husked seed	Clay	2.667	49.33	81.33	85.33	85.33	28.89	4.00	45.33	85.33	89.33	89.33	29.10
	Peat moss	77.33	97.33	97.33	97.33	97.33	24.93	78.66	100.0	100.0	100.0	100.0	24.91
	Sawdust	90.66	98.67	98.67	98.67	98.67	23.92	94.66	100.0	100.0	100.0	100.0	23.87
F-test		**	-	-	-	-	**	**	-	-	-	-	**
L.S.D. 5%		3.37	4.87	4.89	9.30	4.44	0.28	3.94	5.55	6.27	7.17	2.28	0.16

Table (3): The mean germination percentage and germination rate in Goleck mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatment		Percentage of germinated seeds in days after																			Germination rate (days)
		4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	
1992																					
Un-	Clay	0.00	0.00	0.00	0.00	4.00	6.67	10.67	16.00	20.00	21.33	24.00	34.67	30.00	41.33	57.33	65.33	70.67	70.67	70.67	31.51
husked	Peat moss	0.00	0.00	0.00	0.00	5.33	14.67	18.67	21.33	30.67	34.67	56.00	57.33	62.67	69.33	72.00	76.00	77.33	77.33	77.33	30.44
seed	Sawdust	0.00	0.00	0.00	0.00	6.67	8.00	16.00	18.67	29.33	41.33	48.00	61.33	65.33	74.67	76.00	77.33	77.33	77.30	77.30	30.14
Husked	Clay	0.00	0.00	0.00	4.00	5.33	17.33	20.00	38.67	64.00	68.00	00.00	88.00	88.00	88.00	88.00	88.00	88.00	88.80	88.00	29.25
seed	Peat moss	0.00	0.00	33.33	42.67	44.00	92.00	93.33	94.67	94.67	94.67	94.67	94.67	94.67	94.67	94.67	94.67	94.67	94.67	94.67	25.63
	Sawdust	0.00	0.00	36.00	76.00	88.00	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	24.89
1993																					
Un-	Clay	0.00	0.00	0.00	0.00	2.67	6.67	12.00	20.00	22.67	24.00	25.33	38.67	40.00	44.00	61.33	70.67	73.00	73.33	73.33	31.35
husked	Peat moss	0.00	0.00	0.00	0.00	6.67	17.33	20.00	22.67	32.00	40.00	58.67	60.00	65.33	70.67	73.33	73.33	78.67	78.67	78.67	30.35
seed	Sawdust	0.00	0.00	0.00	0.00	8.00	9.33	17.33	20.00	33.33	42.67	52.00	65.33	66.67	70.67	78.67	81.33	81.33	81.33	81.33	30.04
Husked	Clay	0.00	0.00	0.00	6.67	8.00	20.00	20.00	42.67	65.33	69.33	82.67	90.67	90.67	90.67	90.67	90.67	90.67	90.67	90.67	29.12
seed	Peat moss	0.00	0.00	38.67	44.00	48.00	93.33	96.00	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	25.56
	Sawdust	0.00	0.00	44.00	81.33	82.67	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	96.00	24.77

Table (4): F-test, L.S.D.$_{0.05}$, mean germination percentage and germination rate in Goleck mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatments		Mean germination percentage of seeds after (days)					Germination rate (days)	Mean germination percentage of seeds after (days)					Germination rate (days)
		10	18	24	30	40		10	18	24	30	40	
		1992						1993					
Unhusked seed		0.00	18.67	42.67	61.78	75.11	30.73	0.00	20.89	45.33	64.44	77.78	30.58
Husked seed		40.89	76.89	90.67	93.33	93.33	26.59	44.00	78.67	92.00	94.67	94.67	26.48
F-test		**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%		1.90	1.90	5.69	7.59	1.90	0.19	3.29	6.84	11.39	3.70	1.90	0.18
Clay		2.00	27.33	52.00	64.67	79.33	30.38	3.33	31.33	54.00	67.33	82.00	30.23
Peat moss		21.33	58.00	75.33	82.00	86.00	27.94	22.00	60.00	78.00	84.00	88.00	27.80
Sawdust		38.00	58.00	72.67	86.00	87.33	27.67	40.67	58.00	74.00	87.33	88.67	27.56
F-test		**	-	-	-	-	**	**	-	-	-	-	**
L.S.D. 5%		2.94	4.26	3.77	4.26	3.32	0.23	4.86	3.97	4.86	3.97	3.32	0.22
Unhusked seed	Clay	0.00	16.00	24.00	41.33	70.67	31.51	0.00	20.00	25.33	44.00	73.33	31.35
	Peat moss	0.00	21.33	56.00	69.33	77.33	30.44	0.00	22.67	58.67	70.67	78.67	30.35
	Sawdust	0.00	18.67	48.00	74.67	77.33	30.24	0.00	20.00	52.00	78.67	81.33	30.04
Husked seed	Clay	4.00	38.67	80.00	88.00	88.00	29.25	6.67	42.67	82.67	90.67	90.67	29.12
	Peat moss	42.65	94.67	94.67	94.67	94.67	25.65	44.00	97.33	97.33	97.33	97.33	25.56
	Sawdust	76.00	97.33	97.33	97.33	97.33	24.89	81.33	96.00	96.00	96.00	96.00	24.77
F-test		**	-	-	-	-	**	**	-	-	-	-	**
L.S.D. 5%		3.80	5.20	6.84	8.64	4.20	0.33	6.34	7.86	12.20	5.73	4.20	0.30

Table (5): The mean germination percentage and germination rate in Pairi mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatment		Percentage of germinated seeds in days after																			Germination rate (days)
		4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	
1992																					
Un-husked seed	Clay	0.00	0.00	0.00	0.00	0.00	5.33	8.00	12.00	14.67	17.33	30.67	46.67	54.67	65.33	70.67	78.67	78.67	78.67	78.67	31.93
	Peat moss	0.00	0.00	0.00	6.00	2.67	9.33	18.67	26.67	29.33	44.00	54.67	61.33	74.67	77.33	80.00	85.33	85.33	85.33	85.33	30.70
	Sawdust	0.00	0.00	0.00	0.00	4.00	6.67	17.33	28.00	30.67	37.33	48.00	64.00	73.33	82.67	84.00	88.00	88.00	88.00	88.00	30.49
Husked seed	Clay	0.00	0.00	0.00	13.33	17.33	22.67	26.67	73.33	77.33	81.33	90.67	90.67	90.67	90.67	90.67	90.67	90.67	90.67	90.67	28.24
	Peat moss	0.00	41.33	45.33	81.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	24.19
	Sawdust	0.00	38.67	45.33	85.33	98.67	98.67	98.69	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	24.17
1993																					
Un-husked seed	Clay	0.00	0.00	0.00	0.00	0.00	4.00	9.33	13.33	16.00	16.0	029.33	44.00	58.67	66.67	74.67	80.00	80.00	80.00	80.00	32.01
	Peat moss	0.00	0.00	0.00	0.00	4.00	8.00	14.67	24.00	28.00	41.33	56.00	62.67	77.33	81.33	81.33	81.33	81.33	81.33	81.33	30.61
	Sawdust	0.00	0.00	0.00	0.00	5.33	8.00	20.00	26.67	32.00	38.67	46.67	66.67	76.00	81.33	84.00	89.33	89.33	89.33	89.33	30.49
Husked seed	Clay	0.00	0.00	0.00	17.33	17.33	21.33	28.00	72.00	81.33	82.67	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	88.00	28.07
	Peat moss	0.00	45.33	49.33	88.00	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	24.14
	Sawdust	0.00	36.00	52.00	86.67	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	24.05

Table (6): F-test, L.S.D.$_{0.05}$, mean germination percentage and germination rate in Pairi mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatments		Mean germination percentage of seeds after (days)					Germination rate (days)	Mean germination percentage of seeds after (days)					Germination rate (days)
		10	18	24	30	40		10	18	24	30	40	
		1992						1993					
Unhusked seed		0.00	22.22	44.44	75.11	84.00	31.04	0.00	21.33	44.00	76.44	83.56	31.04
Husked seed		60.00	89.78	95.56	95.56	95.56	25.53	64.00	88.89	94.22	94.22	94.22	25.42
F-test		**	**	**	**	**	**	**	**	**	**	**	**
L.S.D. 5%		3.29	3.80	3.70	7.59	1.90	0.13	3.29	7.59	8.27	6.85	5.70	0.13
Clay		6.67	42.67	60.67	78.00	84.67	30.09	8.67	42.67	58.67	77.33	84.00	30.04
Peat moss		40.67	62.00	76.00	87.33	91.33	27.43	44.00	60.67	72.00	89.33	89.33	27.37
Sawdust		42.67	63.33	73.33	90.67	93.33	27.34	43.33	62.00	76.67	89.33	93.33	27.27
F-test		-	-	-	-	-	**	-	-	-	-	**	**
L.S.D. 5%		2.17	2.81	3.20	3.20	2.95	0.16	3.08	3.97	2.99	2.35	2.35	0.16
Unhusked seed	Clay	0.00	12.00	30.67	65.33	78.67	31.93	0.00	13.33	29.33	66.67	80.00	32.01
	Peat moss	0.00	26.67	54.67	77.33	85.33	30.70	0.00	24.00	56.00	81.33	81.33	30.61
	Sawdust	0.00	28.00	48.00	82.67	88.00	30.49	0.00	26.67	46.67	81.33	89.33	30.49
Husked seed	Clay	13.33	73.33	90.67	90.67	90.67	28.24	17.33	72.00	88.00	88.00	88.00	28.07
	Peat moss	81.33	97.33	97.33	97.33	97.33	24.19	88.00	97.33	97.33	97.33	97.33	24.14
	Sawdust	85.33	98.67	98.67	98.67	98.67	24.17	86.67	97.33	97.33	97.33	97.33	24.05
F-test		**	-	-	-	-	**	-	-	-	-	-	**
L.S.D. 5%		3.95	4.77	5.07	8.12	3.80	0.23	4.65	8.48	8.64	7.12	6.06	0.22

Table (7): The mean germination percentage and germination rate in Mabrouka mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatment		Percentage of germinated seeds in days after																			Germination rate (days)
		4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	
1992																					
Un-husked seed	Clay	0.00	0.00	0.00	0.00	0.00	2.67	8.00	13.33	18.67	28.00	38.67	45.33	48.00	66.67	76.00	82.67	82.67	82.67	82.67	31.82
	Peat moss	0.00	0.00	0.00	0.00	4.00	9.33	17.33	30.67	33.33	36.00	40.00	48.00	49.33	60.00	76.00	89.33	89.33	89.33	89.33	30.87
	Sawdust	0.00	0.00	0.00	0.00	1.33	18.67	21.33	30.67	33.33	37.33	45.33	49.33	52.00	62.67	82.67	92.00	92.00	92.00	92.00	30.84
Husked seed	Clay	0.00	0.00	0.00	16.67	17.33	30.67	34.67	73.33	78.67	86.67	86.67	86.67	86.67	86.67	86.67	86.67	86.67	86.67	86.67	27.86
	Peat moss	0.00	40.00	45.33	82.67	96.00	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	98.67	24.24
	Sawdust	0.00	41.33	58.67	84.00	97.33	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	24.18
1993																					
Un-husked seed	Clay	0.00	0.00	0.00	0.00	0.00	4.00	6.67	12.00	17.33	26.67	40.00	44.00	46.67	89.33	74.67	84.00	85.33	85.33	85.33	31.97
	Peat moss	0.00	0.00	0.00	1.33	4.00	8.0	016.00	29.33	33.33	34.67	38.67	44.00	46.67	50.67	60.00	76.00	89.33	89.33	89.33	30.91
	Sawdust	0.00	0.00	0.00	0.00	2.67	9.33	20.00	29.33	34.67	38.67	46.67	46.67	53.33	64.00	84.00	92.00	93.33	93.33	93.33	30.89
Husked seed	Clay	0.00	0.00	0.00	13.33	16.00	29.33	37.33	73.33	77.33	85.33	85.33	85.33	85.33	85.33	85.33	85.33	85.33	85.33	85.33	27.86
	Peat moss	0.00	41.33	48.00	85.33	97.33	98.67	98.67	98.62	98.62	98.62	98.62	98.62	98.62	98.62	98.62	98.62	98.62	98.62	98.62	24.16
	Sawdust	0.00	44.60	49.33	89.33	96.00	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	97.33	24.06

Table (8): F-test, $L.S.D._{0.05}$, mean germination percentage and germination rate in Mabrouka mango seeds as affected by unhusking, husking of seeds and media in different periods in 1992 and 1993 seasons.

Treatments		Mean germination percentage of seeds after (days)					Germination rate (days)	Mean germination percentage of seeds after (days)					Germination rate (days)
		10	18	24	30	40		10	18	24	30	40	
		1992						1993					
Unhusked seed		0.00	24.89	41.33	63.11	88.00	31.18	0.44	23.57	41.76	60.00	89.33	31.26
Husked seed		60.44	90.67	95.11	95.11	95.11	25.43	62.67	89.78	93.78	93.78	93.78	25.36
F-test		**	**	**	**	-	**	**	**	**	**	-	**
L.S.D. 5%		3.80	1.90	5.02	3.29	11.55	0.23	1.90	1.90	0.00	1.90	13.69	0.17
Clay		7.33	43.33	62.67	76.67	84.67	29.84	6.67	42.67	62.67	75.33	85.33	29.92
Peat moss		41.33	64.67	69.33	79.33	94.00	27.55	43.33	63.33	68.67	74.67	94.00	27.54
Sawdust		42.00	65.33	72.67	81.33	96.00	27.51	44.67	64.00	72.00	80.67	95.33	27.48
F-test		-	-	-	-	-	**	-	-	-	**	-	**
L.S.D. 5%		3.97	4.78	4.26	3.87	5.47	0.28	4.53	3.20	4.94	3.97	4.53	0.20
Unhusked seed	Clay	0.00	13.33	38.67	66.67	82.64	31.82	0.00	12.00	40.00	65.33	85.33	31.97
	Peat moss	0.00	30.67	40.00	60.00	89.33	30.87	1.33	29.33	38.67	50.67	89.33	30.91
	Sawdust	0.00	30.67	45.33	62.67	92.00	30.84	0.00	29.33	46.67	64.00	93.33	30.89
Husked seed	Clay	14.67	73.33	86.67	86.67	86.67	27.86	13.33	73.33	85.33	85.33	85.33	27.86
	Peat moss	82.67	98.67	98.67	86.67	98.67	24.24	85.33	98.67	98.67	98.67	98.67	24.16
	Sawdust	84.00	100.0	100.0	100.0	100.0	24.18	89.33	97.33	97.33	97.33	97.33	24.06
F-test		**	-	-	-	-	**	-	-	-	-	-	**
L.S.D. 5%		5.73	5.77	6.73	5.37	12.61	0.40	5.49	4.07	5.71	4.89	14.19	0.29

in the nursery after a short period of planting and decrease the seedling loss during the process of uprooting when sowed in sawdust. Root hairs can be protected from destruction that may be happened in clay soil during transplanting. 4) The possible use of this technique as a wide commercial method in A.R.E to gain very large number of healthy seedlings in a short period by using cheep media. 5) Enhancing seedlings in a very small cultivated area, where the husked seeds is arranged vertically and in paralled manner, so, we can save about 50% of the total cultivated area hy the unhusked seeds. This was noticed by Abdel-Galil (1992) in addition to the results of the present study.

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تأثير وسط الزراعة وتقشير البذور على إنبات بذور بعض أصناف المانجو

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بذور المانجو تحاط بغلاف خشبى يعيق من إنبات البذور فيؤدى إلى احتباس البادرات داخل الغلاف مما يعرضها للتأخر فى الإنبات وتعريضها للتلف قبل امكانية تحررها من القصرة مما يفقد عدد كبير من البادرات التى يمكن الحصول عليها وخاصة فى البذور العديدة الأجنة لإنتاج نباتات مشابهة للأم أو من البذور الوحيدة الجنين لإنتاج أصول للتطعيم عليها . فكانت المحاولة على البذور العديدة الأجنة (الهندى بسنارة والجوليك) والبذور الوحيدة الجنين (البيرى والمبروكة) مع تقشير نصف عدد البذور فى كل معاملة واستخدام ثلاثة أوساط لمهاد البذرة مثل الطين والبيت موس ونشارة الخشب وذلك لدراسة تأثيرها على نسبة وفترة الانبات . وقد صممت التجربة العاملية باستخدام التصميم العشوائى التام مع تكرار المعاملة ثلاث مكررات وأحتوت كل مكررة على ٥٠ بذرة وكانت النتائج كالتالى :

١ – أعلى نسبة انبات كانت مع البذور المقشورة سواء كانت فى البذور العديدة الأجنة (هندى بسنارة ، جوليك) أو الوحيدة الجنين (البيرى والمبروكة) بفارق معنوى عالى .

٢ هناك فروق معنوية عالية فى نسبة الإنبات بين الزراعة فى الأوساط المستخدمة الطينة والبيت موس ونشارة الخشب كانت أعلاها فى نشارة الخشب .

٣ – أمكن الحصول بعد عشرة أيام على أعلى نسبة إنبات تصل الى ٨٣,٠٠% ، ٨٤,٦٧% من جملة البذور المنزرعة فى نشارة الخشب مع تقشير البذور فى البذور العديدة الأجنة أو وحيدة الجنين على التوالى فى حين كانت نسبة إنبات البذور عند تلك الفترة (صفر) فى نشارة الخشب مع عدم تقشير البذور سواء أكانت عديدة الأجنة أو وحيدة الجنين .

٤ – أمكن إجراء عملية الفرز المبدئى على مستوى البذور والبادرات واستبعاد البذور التالفة والضامرة أو البادرات الضعيفة فى وقت مبكر وبذلك يمكن تقليل تكاليف زراعتها فى الأصص.

٥ - أمكن فصل البادرات من البذور العديدة الأجنة والاستفادة منها كمصدر لنباتات مشابهة لنبات الأم أو تمييز البادرات القوية واختيارها كأصول للتطعيم عليها مع سهولة تقليع الشتلات بدون الاضرار بالمجموع الجذرى .

وتوصى الدراسة بأهمية تقشير بذور المانجو وزراعتها فى بيئة نشارة الخشب من اجل الحصول على بادرات بمتوسط ٨٣,٨٤% فى خلال عشرة أيام من جملة البذور المستنبته سواء أكانت أصناف عديدة أو وحيدة الأجنة قبل نقلها إلى الأصص أو أرض المشتل .