

Effect of Seed Maturity on the Germination of Mango (*Mangifera Indica L.*) Seed Stones

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Abstract: This experiment was carried out under nursery conditions at Department of Horticulture, University of Khartoum during season 1999-2000. To study the effect of the stage of fruit development on seeds germination, seeds weight, moisture content and days required for germination for different duration and at two degrees of temperature. The result demonstrated that seed maturity had a significant effect on germination percentage. Seed germination percentage increased with the increase in seed maturity. While number of days required for germination tended to decrease. Dry weight increased and moisture content decreased with maturity. However, seed maturity had no significant on seed fresh weight.

Keywords: Mango, *Mangifera Indica L.*, Seed Germination, Seed Maturity.

I. INTRODUCTION

It is important to know the effect of the stage of seed maturation on its germination. In breeding program experiment much time can be gained by immediate planting of seed collected at earliest possible dates (Crocker and Baton, 1953). Seeds of many species are able to germinate long before physiological maturity. Smooth brome grass seed is capable of germination only few days after fertilization (Grabe, 1956). (Helmer, Delouche and Liennard, 1962) suggested that seeds reach maximum quality at physiological maturity. (Gupta, 1978) found that at physiological maturity, the seed reach it is maximum dry weight and he noted that maximum fresh weight does not necessarily indicate maturity because maturing seeds lose water while nutrients are still moving into the seed and important biochemical process are occurring. (Nichols., Warington and Scoh, 1978) noted that harvest date and seed maturity markedly influenced seed germination and seed moisture content. When seed moisture content of pea was high (35 days after flowering) the seed completely failed to germinate. Whereas, in low moisture content (less than 32 %) almost all seeds germinated. Fruits of Alphonso mangoes reached harvest maturity in 16 weeks after fruit set, the weight continued to increase until harvest, the stone remained soft for 9 weeks after fruit set and subsequently hardened and in about 14 weeks after fruit set it is development was complete.

At fruit set, there are three stages of growth in drupe fruits type. During the first stage the fruit enlarges and the embryo remains small. In the second stage the embryo develops rapidly but the fruit remains static. Further development of fruits takes place in the third stage of

maturity. This process has been referred as "cyclic growth" (Lilleland and Brown, 1936). (Lakshminarayana, Subhadra and Subramanyam, 1970) found that the moisture content of the whole fruit was less than 70 % and increased to 86% in 6 weeks, this was followed by a slight reduction in moisture content 80% and it remained steady after that till harvest, in contrary (Mukherjee, 1959) observed that mango fruit took about 90 days for complete development and physical increase in size and weight stopped 4 to 5 weeks before harvest maturity. The time of development after fertilization to maturity of mango fruit was 2-5 months depends on cultivar and temperature (Purseglove, 1969).

II. MATERIAL AND METHOD

Two cultivar of mango were selected (Alphonso and D. Knight). Three trees from each cultivar were selected. These two cultivars flowered. Two hundred fruits were tagged in each tree after fruit set. After 45 days from flowering 20 fruits were harvested randomly from each tree and there after 10 days until the end of the season (135 days after flowering) Total number of fruits harvested at each harvest were 120fruit (1200 fruit for all experiment). Fresh weight, dry weight and moisture content were determined each time. Sixty were planted immediately using completely Randomize design with 3 replicates and 2 plots with 10 seed stones each. Sowing of seed stones was performed by planting seed stones in small poly ethylene bags 14x20 cm containing soil mixture of river silt and sand at ratio 2:1 (by volume) with their convex side up. The bags were irrigated immediately after sowing then daily until the emergence of seedlings and twice a week after that. Observation of germinate were carried out for three months

Growth parameters were evaluated in terms of germination percentage, fresh and dry weight moisture content and number of days required for emergence as follow:

1. Germination percentage was calculated at the end of the experiment using the following formula

$$G.P. = \frac{\text{Numbers of germinating seeds}}{\text{Total numbers of seed sown}} \times 100$$

2. Seed fresh weight g\seed stone: Calculated immediately after extraction seed stone from fruits for 30 seed stones for each cultivar.

3. Seed dry weight g\seed stone: Calculated after dried se-

ed stones at oven at 70 C.

4. Moisture content was calculated for 30 seed stones for each cultivar using the formula of Roberts (1972):

$$\text{moisture(wet - weight basis)} = \frac{\text{weight of water}}{\text{weight of water} + \text{weight of dry water}} \times 100$$

The number of days required for emergence was recorded from days of sowing until the emergence of first seedling from seed bed.

III. RESULT AND DISCUSSION

Germination percentage: The result revealed that 95, 105 and 120 days after flowering had highest germination percentage and generally germination percentage was not affected by delaying the harvest after 75 days after flowering Table (1). The result also showed that cultivars had no significant effect on germination percentage. These findings are in agreement with those reported by (Cochran, 1943) who found that the stage of maturity of fruit had a direct effect upon germination of pimiento seeds. Seeds planted upon removal from fruit did not give more than 6.1% germination. Which in ripened fruits in red color only 68.5% of their seeds germinate. Bright red fruits as well as those which remained on plant until they were dark red and shriveled yielded seeds with 96% germination capacity. (Abdalla, 1996) found that seeds obtained from green fruits whether they were decorticated or undecorticated resulted in lower germination percentage; while (William, 1988) found that seeds of *Buta capitata* extracted from yellow green fruits gave lower germination percentage compared to seeds extracted from dark yellow fruit.

This might be due to the fact that ripe fruit had completed all the physiological processes relating to the development of the seeds, whereas green fruit did not complete such activities which enable them to germinate, and good germination and strong plants could be secured from quiet immature but fairly well developed.

Seed moisture content, number of days required to emergence, dry weight and fresh weight were clearly affected by maturity. As shown in the results seeds at early ages (45 and 60 DAF) had the highest moisture content (83.4 or 74.5%) Table (2) and longer days to emergence (27.3 or 14 days) Table (3). And at maturity seed had lowest moisture content (30.3 or 33.7%) with increase in germination capacity (81.7 or 100%) and lower days required for emergence (12.33 or 12 days) Table (3). These findings are in agreement with those reported by (Nichols., Warington and Scoh, 1978) who found that at early ages of other species (35 days after flowering) moisture content was high but seeds failed to germinate and at maturity moisture content was less than (32%) and almost all seeds germinate. Similar findings were reported by (Dhar, Pantey and Tewari, 1999) who observed that various development stages of *Aisandra butyraceae* (Roxb) Baehni and found that immature kernels had

maximum moisture content 72% (with 20 % germination percentage) which decrease to 32 % in mature kernels (with 95 % germination percentage). The results are in agreement with those reported by Abdalla (1996) who found that with mango seed stone greater number of days required for germination were associated with seed extracted from green fruit.

This may be due to the fact that at physiological maturity seeds being losing water while nutrient are still moving into the seeds and important biochemical process are occurring (Gupta, 1978) and the seeds from firm fruits remained dormant to complete certain physiological phenomenon to enable them to germinate. Thus seeds from firm ripe fruits remained ungerminated in soil for longer time this reduced the germination capacity of the seeds (Giri, 1966).

Also the results show that at early seed stone formation dry weight tend to increased steadily until maturity Table (4), but maturity had no significant effect on fresh weight of the seed Table (5), and Alphonso cultivar had higher fresh weight than Dr. Knight. In contrast (Hartman and Kester, 1968) reported that heavier seed resulted in better germination percentage. Similar findings were reported by (Giri and Chaudhry, 1966) found that seeds heavier in weight gave the maximum germination percentage (80.75%) than medium (65.0%) or lighter (58.25%).

This may be due to the fact that when seeds begin to mature more reserve material accumulates within the seed. These materials originate as carbohydrates by photosynthesis in the leaves and translocated to seeds. This process takes place in the final developmental period of fruit growth. The seeds become heavier in their size and quality. So at physiological maturity, the seeds reached its maximum dry weight but it does not necessarily reached maximum fresh weight because mature seeds begin losing water while nutrients are still moving into the seed and important biochemical processes are occurring.

Table (1): Effect of seed maturity on germination percentage of mango seed stones of two mango cultivars, season 1999\2000- 2000\2001.

Seed maturity (days)	Dr. knight		Maturity mean
	Alphonso	Dr. knight	
1999\2000			
60 DAF	40	40	40 ^{c*y}
75 DAF	80	80	80 ^b
90 DAF	80	80	80 ^b
105 DAF	100	100	100 ^a
120 DAF	100	100	100 ^a
Cultivars mean	80	80	
2000\2001			
45 DAF	10.0 ^{f*z}	30.0 ^{ef}	20.0 ^{e*y}



55DAF	20.0 ^f	70.0 ^{cd}	45.0 ^d
65 DAF	50.0 ^{dc}	66.7 ^{cd}	58.3 ^{cd}
75 DAF	83.3 ^{abc}	90.0 ^{abc}	86.7 ^{ab}
85DAF	93.3 ^{ab}	83.3 ^{abc}	88.3 ^{ab}
95DAF	96.7 ^{ab}	90.0 ^{abc}	93.3 ^a
105 DAF	93.3 ^{abc}	100.0 ^a	96.7 ^a
115DAF	70.0 ^{dc}	90.0 ^{abc}	80.0 ^{bc}
125DAF	96.7 ^{ab}	66.7 ^{cd}	81.7 ^{ab}
135DAF	96.7 ^{ab}	66.7 ^{cd}	81.7 ^{ab}
Cultivars mean	71.0	75.3	

*y Means of column followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test(DMRT).

*z means within rows\ row followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT).
 DAF = (Days after flowering).

Table (2): Effect of seed maturity on moisture content of mango seed stones of two mango cultivars, season 1999\2000- 2000\2001.

Seed maturity (days)	Alphonso	Dr. knight	Maturity mean
1999\2000			
60 DAF	80.9 ^{a*z}	68.1 ^b	74.5 ^{a*y}
75 DAF	42.3 ^{cd}	50.1 ^c	46.2 ^b
90 DAF	33.2 ^e	39.9 ^{de}	36.5 ^c
105 DAF	33.6 ^{de}	36.2 ^{de}	34.9 ^c
120 DAF	32.8 ^e	34.7 ^{de}	33.7 ^c
Cultivars mean	44.6	45.8	
2000\2001			
45 DAF	82.0 ^{a*z}	82.7 ^a	82.43 ^{a*y}
55DAF	67.2 ^d	76.5 ^b	71.8 ^b
65 DAF	60.7 ^c	71.4 ^c	65.9 ^c
75 DAF	56.9 ^f	61.3 ^e	56.1 ^d
85DAF	51.7 ^g	52.4 ^g	52.1 ^e
95DAF	46.2 ^h	44.7 ^h	45.4 ^f
105 DAF	44.2 ^{hi}	43.0 ^{hij}	43.6 ^f
115DAF	40.9 ^{ijk}	39.2 ^{kl}	40.1 ^g
125DAF	37.9 ^{kl}	36.0 ^{lm}	36.9 ^h

135DAF	26.81 ^m	33.8 ^m	30.3 ^h
Cultivars mean	51.4 ^{b*z}	54.1 ^a	

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Table (3): Effect of seed maturity on days required for emergence of mango seed stones of two mango cultivars, season 1999\2000- 2000\2001.

Seed maturity (days)	Alphonso	Dr. knight	Maturity mean
1999\2000			
60 DAF	14	14	14
75 DAF	13	13	13
90 DAF	12	12	12
105 DAF	12	12	12
120 DAF	12	12	12
Cultivars mean	12.6	12.6	
2000\2001			
45 DAF	20.3 ^{c*z}	34.3 ^a	27.3 ^{a*y}
55DAF	17.7 ^d	31.3 ^b	24.5 ^b
65 DAF	13.3 ^{ef}	14.7 ^e	14.0 ^c
75 DAF	12.7 ^{ef}	13.0 ^{ef}	13.0 ^{cd}
85DAF	12.7 ^{ef}	13.0 ^{ef}	12.8 ^{cd}
95DAF	12.0 ^{ef}	13.0 ^{ef}	12.5 ^{cd}
105 DAF	11.3 ^f	11.3 ^f	11.3 ^d
115DAF	12.0 ^{ef}	12.7 ^{ef}	12.3 ^{cd}
125DAF	12.0 ^{ef}	13.0 ^{ef}	12.5 ^{cd}
135DAF	12.0 ^{ef}	12.7 ^{ef}	12.3 ^{cd}
Cultivars mean	13.6 ^{b*z}	16.9 ^a	

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Table (4): Effect of seed maturity on dry weight of mango seed stones of two mango cultivars season 1999\2000-2000\2001.

Seed maturity (days)	Alphonso	Dr. knight	Maturity mean
1999\2000			
60 DAF	5.2 ^{e *z}	6.4 ^{de}	5.8 ^{c*y}
75 DAF	13.8 ^{bc}	10.5 ^{cd}	12.1 ^b
90 DAF	16.9 ^{ab}	13.7 ^{bc}	15.3 ^a
105 DAF	19.3 ^a	15.7 ^{ab}	17.5 ^a
120 DAF	19.4 ^a	15.9 ^{ab}	17.7 ^a
Cultivars mean	14.9 ^{a *z}	12.5 ^b	
2000\2001			
45 DAF	4.6 ^{e *z}	3.5 ^e	4.1 ^{b *y}
55DAF	8.4 ^{cd}	4.9 ^e	6.6 ^g
65 DAF	9.7 ^{bcd}	6.3 ^{de}	8.0 ^f
75 DAF	10.4 ^{abc}	8.6 ^{cd}	9.5 ^e
85DAF	11.4 ^{abc}	10.6 ^{abc}	11.1 ^d
95DAF	12.1 ^{ab}	12.2 ^{ab}	12.2 ^c
105 DAF	12.3 ^{ab}	12.6 ^{ab}	12.4 ^{bc}
115DAF	13.2 ^a	13.0 ^{ab}	13.1 ^{ab}
125DAF	13.2 ^a	13.2 ^a	13.2 ^{ab}
135DAF	13.8 ^a	13.3 ^a	13.5 ^a
Cultivars mean	10.9 ^{a *z}	9.8 ^b	

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*z means within rows\ row followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test (DMRT).

Table (5): Effect of seed maturity on fresh weight of mango seed stones of two mango cultivars, season 1999\2000- 2000\2001.

Seed maturity (days)	Alphonso	Dr. knight	Maturity mean
1999\2000			
60 DAF	27.0	20.1	23.6
75 DAF	24.1	21.1	22.6
90 DAF	25.3	23.0	24.2
105 DAF	29.1	24.5	26.8

120 DAF	28.9	24.4	26.7
Cultivars mean	26.9 ^{a *z}	22.7 ^b	
2000\ 2001			
45 DAF	21.8	19.9	20.8
55DAF	25.2	20.6	22.9
65 DAF	24.6	21.7	23.1
75 DAF	21.6	22.1	21.9
85DAF	23.7	21.9	22.8
95DAF	22.5	22.0	22.3
105 DAF	21.9	21.8	21.9
115DAF	21.8	21.4	21.6
125DAF	21.3	21.6	21.4
135DAF	21.7	20.6	21.2
Cultivar mean	22.6 ^{a *z}	21.4 ^b	

*y Means of column followed by the same letters are not significantly different at 0.05 level of probability according to Duncan's multiple range test(DMRT).

*z means within rows\ row followed by the same letters are not significantly different at level of probability according to Duncan's multiple range test (DMRT).

IV. CONCLUSION

Mango seed stone should be planted immediately after picking from ripe fruit.

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