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# STUDIES ON SOME MULTIUSES OF *Annona. senegalensis* AS POLLINATOR, ROOTSTOCK AND POLLINATION TREATMENTS FOR IMPROVING FRUIT SET PERCENTAGES AND FRUIT QUALITIES

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## ABSTRACT

The studies were conducted during the two successive seasons of 2001 and 2002. The studies aimed to focus on *A. senegalensis* as multiuses fruit tree which was not established enough in Egypt. Some of the uses are investigated in the present study (1) The use as pollinator, (2): The availability of non edible fruits to be used in food processing and trial to solve processing problems using cross hand pollination of *Annona atemoya, A.squamosa* and selected Squamosa male parents. Pollination *is also used* for improving fruit qualities to meet the future needs of processing. (3): The use as rootstock for different cherimoya (Annona) species, (4): The availability of seeds to produce sufficient rootstocks and some and the best container, (5): fresh consumption. The data indicated the effeciency of using *A. senegalensis* as pollinator for other annona in controlled pollination increasing fruit weight, pulp and TSS percentage while decreasing seed number and could be used also as complementary pollinator during lack of pollen. The primery studies encourage the processing to of fruits and trial to improve qualities for processing by pollination of other annonas increased pulp weight. The tree had superior survivability under different environments and is excellent rootstock to known and selected annonas, the growing in black bags is better than plates and pots to raise suitable rootstocks. The *annona senegalinses* is a fighter tree under different conditions and multiuses easy propagated tolerant tropical fruit tree recommended to be more established. The disadvantage is the high seed number could be overcome buy pollinating with good variety or use the seeds for medical or natural pesticide uses

**Keywords:** Annona cherimoya Senegalensis pollination, pollinator, improvement dates rootstock seed containers Alexandria.

**Abbreviations**: CH (Cherimata), Slec (selected squamosa), Sq (squamosa)

## INTRODUCTION

The Annona (Cherimoya) include more than 120 species. The most known edible species are *A. squamosa, A. atemoya* (Hybrid of *A. Cherimolia x A. squamosa* ) are distributed in tropical and subtropical areas. The fruits had rich white or red flesh. There are many cultivars which differ in seed number, sweetness and other fruit qualities. The annona fruits, seeds, trunk, roots and leaves have different industrial, medicinal pesticides and commercial uses in their native lands (Morton, 1987). The *Annona senegalinses* is one of the introduced annona species in Egypt (Ahmed, 1963 ) and is used successfully in scientific researches as pollinator For other annonas during the periods of

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lack of pollen grains (Othman and Badr,1995) and George *et al* (1997) and tolerant rootstock for other annonas (Badr,1997)..The fruits differ than other annonas in its bright orange pulp and orange or yellow orange smooth skin, while other edible annonas had white pulp and green purtuberanced skin except few selected cultivars (Badr, 1997). This encourage processing for its low peel percentage and special attractive pulp color The high number of seeds were used for raising rootstocks which were grafted by other annona varieties. As the fruit taste are not accepted by consumers like other annonas, so the high amount of pulp is discarded. The question is why don't we get benefit and use this pulp in processing to increase the profitability of its high yield and spread the plantation of such multipurpose tree (as rootstock, pollinator and processed products). This is complete non-expensive profitable project because of low fruit prices as unaccepted for fresh consumption, On the other hand there are other medical uses of the tree. Other tradional uses were mentioned in the literature using *A. senegalensis* as medicinal plant and for extracting effective substances for canser cure (Crane, 1963, Morton, 1985 and Nakasone and Paul, 1998).

The aim of the present research is to establish growing and getting more benefits of such multiuses annona spp. ( *Annona senegalensis* ) which is used as rootstock or pollinator ,while its high naturally produced fruits is not used in fresh consumption for its unacceptable taste in contrary in original countries and hotter periods. On the other hand, growing these trees has no great costs because of its high seed number, high germination percentages and easy growing than other species and its tolerance under different environments.

## MATERIALS AND METHODS

Some of the different uses of *A. senegalensis* were investigated in the present study including the following Items.

**1-The use of *A. senegalensis* as pollinator:**

The efficiency of *A. senegalensis* as pollinator for other cherimoyas (annonas) was studied. The pollination treatments were done as mentioned by Othman and Badr (1995), using *A. senegalensis* pollen grains (as male parent) for mother trees *A. atemoya* (Cherimata CV ), *A. sqamosa and* selected squamosa. The pollination treatments were done on three replicates of trees for each cultivar. The treatments were conducted during July 2001 and 2002 using paint brush for opened flowers of mother trees. The pollen was taken from *A. senegalensis* flowers collected in the previous day and left all night to shed pollen, which were preserved in small tubes. The flowers of mother trees were emasculated and covered with small muslin bags for three day after pollination. Fruit set percentage was determined as number of fruit set from 300 pollinated flower for each treatment during the season. Compound fruit samples were collected during harvest of 20 fruits for each treatment for determining average fruit weight, length, diameter, pulp, seed and peel percentages. TSS was determined by hand refractometer, acidity as citric acid equivalent was determined using titration with NaOH (1%) as mentioned in AOAC (1990).

**2-The use of *A.senegalensis* fruits for processing**

**2-a:** fruit processing

A side experiment with the help of food technology division was done by processing pulp of *A. senegalinsis* fruit to jam in 2000 season to determine acceptability and advantages and disadvantages of using such neglected fruit to get benefit of its natural amount of yield (without pollination need). The materials used for processing: fruit pulp extracted from fresh full colored fruits (100 fruit). The seeds were removed and pure pulp was processed to jam using 1: 1.25 fruit: sugar weight. The panelist test was done by 12 panelist's of the taste, color, odor, texture, appearance was tested and panelist's degrees from 1 to 9 were put as following:

Like extremely (9), like very much (8), like moderately (7), like slightly (6), neither like nor dislike, (5), dislike slightly (4), dislike moderately (3), dislike very much (2) and dislike extremely (1).

**2-b: Pollination trials to overcome processing problems:**

The primary fruit characteristics from food technology point of view, indicated high seed number and proportionally low pulp percentage. Pollination treatments were done during 2001 and 2002 seasons to improve fruit qualities needed for processing and to overcome the problems. Pollen grains were taken from opening flowers of *A. atemoya* (Cherimata CV), *A. Squamosa* and *selected A. squamosa* characterized with bigger size, sweetness, lower seed number and non separated carples after ripening which gave it better performance and tolerant than squamosa fruits. The flowers were kept overnight at room temperature and pollen grains were put in glass tube. In the next morning. pollination treatments were done on three replicates of *A. senegalensis* trees during July of 2001 and 2002 . All treatments were done on equal number of flowers daily (10). Self-pollination of *A. senegalensis* was also done. Fruit weight, peel, pulp and seed weight were determined and percentages of pulp, seed and peel were calculated. TSS and acidity percentages were determined according to AOAC (1990).

**3- The use of *A. senegalensis* as rootstock for different annona species**

The use of A. *senegalensis* as rootstoock for some cultivars adapted at Alexandria including new selected cultivars were also studied. Top work grafting using pens about 30 (cm). length 1.5 cm. diameter were used from mother trees during April (2001 and 2002) of *A. cherimolia* which is adapted at Alexandria, new selected cultivars of Nagi and Badr and known selected cherimata variety. The rootstocks of *A. senegalensis* were 1.5 years old grown at nursery of governmental orchard at Alexandria. The rootstock was cut at height of 30 cm. above ground and 10 cm. longitudinal section was done dividing rootstock symmetrically from top to down. Similar length of the scion was cut from both sides and put inside the rootstock section and tied firmly with graft plastic tie. The section of rootstock and scion was longer in the present study to avoid separating of graft and scion during winter windy months in the area. On the other hand, the use of rootstock at age more than one year to avoid loss of rootstocks which was affected during the first winter by similar environments. The grafting was done during April to early May as

the new growth in the district began later than hot districts. The data of graft success percentages were recorded on random 30 graft of each grafted cultivars representing all sides of the nursery.

**4- Seed germination percentage**

The studies also included seed germination as indicator to the efficiency of *A. senegalenses* seeds to produce rootstocks available for grafting. The seeds were sown comparing the percentages intake during April 2001&2002. Different seed containers including black plastic bags (50 x 50) & (20 x 15 ), pots (20 x20 ) and plates ( 30 x 5 cm.) were used each of 5 replicates containing 50 seed to determine the best container during 2001 and 2002. The number of seedlings and percentages were calculated. The average seedling length was recorded after 2 months.

**5-Tolerance to drought, salinity and flooding and rainy windy winter**

The data were taken on adult trees (about 38 years old), exposed naturally to drought, flooding or hot periods. The data were taken on survivability percentage and number of fruit per tree from 199 to 2004 as a report during the work and to continue the first report research from 1989 to 1996 (Badr, 1997)

All data were statistically analized using ANOVA according to Snedecor and Cochran (1980) using CRBD of three replicates of each treatment.

## RESULTS AND DISCUSSION

**1-The use of *A. senegalensis* as pollinator for other cherimoyas**

**1-a:** The data in Fig (1) represented the effect of using *A. senegalensis* as pollinator on fruit set of *A. squamosa* and *A. atemoya* (Cherimata Cv.) and selected squamosa. A tendency to alternate bearing was noticed in both seasons for both mother trees. The use of *A. senegalensis* as pollinator showed the highest fruit set percentage in 2002 for atemoya than all treatments of both seasons.and was higher in 2001 than 2002 for squamosa.in contrary to selected squamosa This indicate that the use as pollinator depend not only on the treated mother tree, but also on season, so it is better to use both treatments of self and senegalensis as mixed pollination especially during periods of lack of other pollen as complementary treatments to increase fruit set of other mother trees.

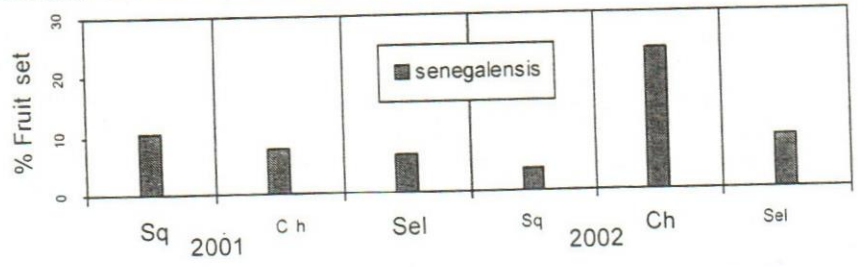


**Fig. (1): fruit set percentages of *A. senegalensis*in as polleninator of Squamos, cherimata, selected squamosa compairing with their self pollination treatments in 2001 and 2002.**

The use of other pollen to increase fruit set is also suggester by Badr (1997). Kahn *et al* (1994) reported that maternal cultivar had a significant effect on fruit set.

**1-b: Effect on fruit qualities:** The data indicated that use of A. senegalensis as pollinator increased average fruit weigh, pulp percentage and TSS of selected squamosa and Cherimata than Squamosa in 2001 and 2002 (Tables 1 & 2). Significant differences were found between the highest pulp weight of selected squamosa (134 & 162.5) followed by Cherimata (75 & 115.2) and the lowest were those of squamosa (49 & 68) in both seasons, respectively (Tables, 1&2). Although the peel weight of selected squamosa is significantly higher, but comparing with fruit weight it is considered lower than both Cherimata and squamosa values in both seasons. The seed number is low in all treatments of both seasons with significant increase of squamosa fruits in 2002. The TSS values were generally higher using senegalenses hand pollination in both seasons (Tables, 1 & 2). It was generally noticed that senegalensis pollen increased pulp weight and decreased seed weight and number. The use of senegalensis pollen on selected squamosa meet the ideal selection criterias mentioned by George, *et al* (1997), regarding fruit weight, pulp percentage, seed number , peel and seed weight and somewhat TSS. This indicate that A. senegalensis is good pollinator for selected squamosa, Cherimata and could substitute or be additive pollen during periods of lack of flowers. This agree with the data obtained by Othman and Badr (1995) and Badr (1997) who encourage the presence of more than other annona variety or spp. to be available for pollination of other annonas.

**Table (1): Effect of using pollen grains *Annona senegalensis* for pollination treatments of Annona Spp. female parent on fruit qualities in 2001**

| Female parent | Fruit weight (gm) | Pulp weight (gm) | Seed number | Seed weight (gm) | Peel weight (gm) | TSS % | Acid % |
|---|---|---|---|---|---|---|---|
| Cherimata | 137 | 076.0$^{b}$ | 29b | 22.0 | 39.0$^{b}$ | 15.2 | 0.142 |
| Squamosa | 090 | 049.0$^{c}$ | 43$^{a}$ | 14.0 | 27.0$^{c}$ | 16.7 | 0.106 |
| Selected squamosa | 225 | 134.8$^{a}$ | 22$^{b}$ | 14.0 | 76.2$^{a}$ | 16.3 | 0.124 |

Simmilar letters has no significant differences.

**Table (2): Effect of using pollen grains *Annona senegalensis* for pollination treatments of Annona Spp. female parent on fruit qualities in 2002.**

| Female parent | Fruit weight (gm,) | Pulp weight (gm.) | Seed number | Seed weight (gm.) | Peel weight | TSS % | Acid % |
|---|---|---|---|---|---|---|---|
| Cherimata | 173. | 115.2$^{b}$ | 23$^{b}$ | 11.8 | 45.0$^{b}$ | 13.8 | 0.134 |
| Squamosa | 129 | 068.0$^{c}$ | 45$^{a}$ | 15.3 | 45.5$^{b}$ | 15.2 | 0.224 |
| Selected squamosa | 236 | 162.5$^{a}$ | 23$^{b}$ | 15.3 | 58.2$^{a}$ | 16.3 | 0.124 |

Simmilar letters has no significant differences.

**Primary trial for processing**

The data illustrated in Table (3), showed the characteristics of fruits resulted from chance pollination from food technology point of view indicated

low percentage of pulp available for processing although the good fruit weight. Hight weight of by-products low sugar content and high ascorbic acid content was noticed. The jam was processed without need of adding pectin and had beautiful bright orange color with final TSS of 73 % (table, 4). The data in the same table indicated high acceptability of fruit jam.

**Table (3): Primary evaluation of *A.senegalensis* fruit characteristics (Chance pollination in 2001 and 2002.**

| Season | Fruit weight (gm) | Fruit Size (cm)³ | Byproduct* Weight (gm) | Pulp (%) | TSS (%) | Refraction factor | Ascorbic Acid mg\ 100 ml juice |
|---|---|---|---|---|---|---|---|
| 2001 | 245 | 258a | 145[a] | 40.8[a] | 8.0 | 1.3445 | 2.623 |
| 2002 | 260 | 211[b] | 65.3[b] | 34.7[b] | 8.5 | 1.4230 | 2.670 |

*= weigh of seed + peel + fibers  Simmilar letters has no significant differences.

**Table (4): Physical properties of *A. senegalensis* and panelist evaluation (degree and acceptability).**

| Fruit jam Property | Color | Taste | Odor | Texture | Appear-ance | TSS (%) | Fruit/sug ar weight |
|---|---|---|---|---|---|---|---|
| Degree of | 8.25 | 8.98 | 8.00 | 7.02 | 8.01 | 73 | 1:125 |
| Acceptability | LVM | LE | LVM | LM | LVM | - | - |

Simmilar letters has no significant differences.

Panelists indicated excellent results for taste and accepted color (bright orange), odor, texture (although no pectin was added), and good appearance. This encourage the processing such undesirable fruits and the need of hand pollination to improve fruit qualities needed for processing such as increasing pulp percentage and decreasing seed number and weight. The trees are naturally productive (without hand pollination) and hand pollination is needed to improve and increase yield like other annonas as found by Othman and Badr (1995). and Badr (1997). The fruits nutrition value is high. , the only exception is the high seed number and sometimes the buttery taste make people do not accept it. Trials were done to make fruits more acceptable for fresh consumption and to improve availability of processing by using hand pollination with the pollen of other annonas to improve qualities. The primary results of processing *Annona senegalensis* fruits indicated the acceptability of taste, texture and physical properties of jam products. Cranr (1993) reported that the Atemoya is primarily consumed as a fresh fruit but the pulp is used in desserts, salads, ice creams, and milk shakes. Also the properties and clear yellow bright color of *A. senegalensis* fruits encourage processing to other products with high nutritional value.

**2-b: Pollination trials to overcome processing problems:**

According to the previous mentioned problems that faces the *Annona senegalensis*, pollination trials to improve characteristics for both fresh consumption and processing were illustrated in tables ( 5 and 6 ), which indicated significant increase of fruit weight using all treatments more than Cherimata in 2001 (Table, 5) in contrary to 2002 (Table, 6). Significant

increase of pulp weight percentages of all treatments more than Cherimata in 2001 while significant decrease was noticed in 2002 (Table, 6) in 2002. Considerable significant decrease in seed number in 2001 of Squamosa treatment and peel weight percentage of self *A. senegalensis*. The TSS resembled that of female *A. senegalensis* of chance pollination (Table, 3). Kahn *et al* (1994) reported that pollen parent cultivar produced significant differential effects on fruit and seed characteristics or xenia. Pollen parent cultivar had significant effects on fruit characters such as fruit length, fruit weight and percentage fruit set. Seed characters were significantly affected by pollen parent included seed weight per fruit, seed number and mean seed weight. Other fruit characters such as fruit diameter, length/diameter ratio, grams of fruit flesh per seed, and days to maturity, although not significant, exhibited trends toward xenia.

**Table (5): Effect of of *annona squamosa* and, squamosa ( selected) and cherimata for pollinating treatments on senegalensis female parent on fruit qualities needed for processing in 2001**

| Character / Male parent | Fruit weight (gm) | Pulp weight (%) | Seed number | Seed weight (%) | Peel weight (%) | TSS (%) | Acid (%) |
|---|---|---|---|---|---|---|---|
| Self | 198$^{b}$ | 77.88$^{a}$ | 114$^{b}$ | 16.07$^{b}$ | 05.05$^{d}$ | 9.8 | 0.22 |
| Cherimata | 114$^{c}$ | 35.27c | 115$^{b}$ | 33.33$^{a}$ | 31.40$^{a}$ | 7.5 | 0.25 |
| Squamosa | 187$^{b}$ | 55.90$^{b}$ | 012$^{c}$ | 17.37$^{b}$ | 26.73$^{b}$ | 8.6 | 0.28 |
| Selected squamosa | 238$^{a}$ | 66.44$^{a}$ | 142$^{a}$ | 16.30$^{b}$ | 17.2$^{c}$ | 7.7 | 0.37 |

Simmilar letters has no significant differences.

**Table (6): Effect of using pollen grains of *A, squamosa* and, squamosa (selected) and cherimata for pollination treatments on senegalensis female parent on fruit qualities needed for processing in 2002.**

| Male parent | Fruit weight | % Pulp weight | Seed number | % Seed weight | %Peel weight | % TSS | % Acid |
|---|---|---|---|---|---|---|---|
| Self | 164.0 | 48.08$^{b}$ | 130 | 23.6$^{ab}$ | 30.32 | 8.0 | 0.32 |
| Cherimata | 183.0 | 51.43$^{b}$ | 127 | 21.8$^{ab}$ | 26.77 | 7.0 | 0.27 |
| Squamosa | 185.0 | 56.02$^{a}$ | 124 | 20.2$^{b}$ | 23.78 | 9.0 | 0.31 |
| Selected squamosa | 135.4 | 4810$^{b}$ | 098 | 25.4$^{a}$ | 26.50 | 7.8 | 0.30 |

. Simmilar letters has no significant differences.

Fairchild (1990) reported that the purpose of the initial crosses among sugar apples and cherimoyas was to incorporate the excellent fruit quality and cold tolerance of the subtropical adapted cherimoyas (which did not grow or fruit well in humid lowland areas like south Florida) with the sugar apple which is well adapted to warm, humid, subtropical, and tropical climates. Some seedlings of these early crosses appeared to produce fruit with excellent quality and possessed sufficient cold hardiness to have survived freezing weather in 1917 (Morton 1987). This agree with the present case of *A. senegalensis* which adopted in this area of Mediterranean sea and encourage the pollination trials to improve fruit characteristics as done in the

present study. The response of different cherimoyas to senegalensis pollen showed differences in both seasons in accordance to Gardiazabal (1999) who reported different responces of 10 cherimoya cultivars using artificial pollination. This may be due to interaction of paternal and maternal effect which changes according to amount of pollen and pollinated stigmas.

The fruit set percentages of different pollinators on *A. senegalensis* mother trees indicated that the highest fruit set was obtained using self pollination treatment followed by atemoya (Cherimata) pollen during the peak flowering period in 2002 followed by Senegalensis, Squamosa and the lowest is selected squamos ( Fig., 2)

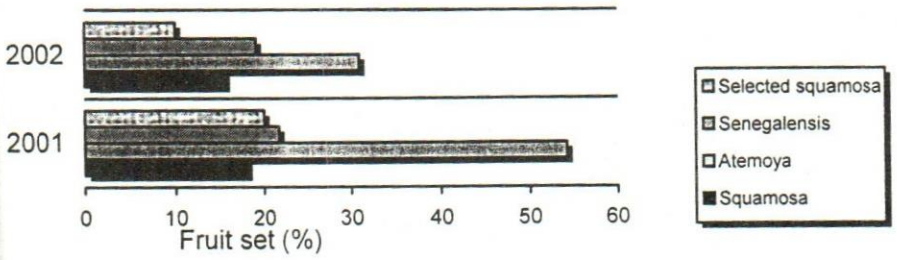


**Fig. (2): fruit set percentages. Of *A. senegalensis,* Cherimata, Squamosa and selected Squamosa pollination treatments on *A. senegalensis* in 2001 and 2002**

**3-The use of a senegalensis as a rootstock for different annona species**

Trials of top grafting using different annonas on senegalensis rootstook indicated that, the percentages of success ranged from 84.6 for cherimolia grafts to 100 % for Finny, cherimata and Nagi cultivars (atemoya selections), while Badr cultivar was intermediat ( 94 %) in 2001. All atemoya selections were higher than cherimolia in both seasons The data of 2002 season decreased for finny, cherimata and Nagi atemoya selection and increased for Badr (new atemoya selection) and slightly for cherimolia. All percentages are considered high in both seasons. . Chauvatia and Singh (1999), working on multiplication of custard apples (Annona squamosa, cv. Sindhan Local) found that grafting success (73.53%) was higher on average than that of budding. Irrespective of the method used, greater success was achieved when performed in March (91.11%) or April (85.00%) in agreement with the present study in which all treatments were done in April and and ranged from 84.6 -100 % success according to cultivar and season. The best results (97.5% take) were obtained when the rootstock age was more than 10 month old as found by Lederman, *et al.* (1997). The rootstock age in the present study was 16 month gave 84.6 to 100% success according to cultivar and season and was completely contacted to scion and never separated. Leon *et al* (1999) reported that. Cherimoya is propagated by grafting, with the aim of preserving genetic characteristics and the best method of grafting is terminal scion grafting as done in the present study with good results. Crane (1993) reported that several rootstocks have been recommended for atemoya, including pond apple (*A. senegalensis*)

**Table (7): Percentage of succeeded grafts of A. cherimolia, Annona atemoya (Cherimata variety and selected cultivar) in 2001 and 2002 seasons.**

| Scion species cultivars | *A.cherimolia* | *A.atemoya* | | | |
|---|---|---|---|---|---|
| | | Finy | Cherimata | Nagi | Badr |
| 2001 | 084.6 | 100.0 | 100.0[a] | 100.0 | 094.0 |
| 2002 | 085.7 | 091.0 | 090.8[b] | 090.9 | 098.0 |

**4-Seed germination percentage for raising rootstock is determined**

The data in table (8) indicated that the growing of *A. senegalensis* seeds produced the highest percentages of seedlings when grown in Bags (20 x 15) cm.(medium size) followed by bags (50 x 50 cm)., pots (20 x 20 cm.) and the lowest in plates (30 x 10) in 2001 , while medium bags and pots produced the highest percentages of seedlings in 2002. No significant differences were found either in sucsess percentages or seedling length which was longer in bags (50 x 50 cm.), medium bags and lowest in plates in both seasons..

**Table (8): Effect of containers on seed germination percentage and seedling length of *A senegalensis* in 2001 and 2002.**

| Container | 2001 | | 2002 | |
|---|---|---|---|---|
| | % success | Av.Length (cm.) | % success | Av. Length (cm.) |
| Bags50x50cm | 53.0 | 32.3 | 52.0 | 35.7 |
| Bags 20x15 | 80.9 | 29.3 | 88.8 | 31.7 |
| Pots 20x20 | 50.4 | 14.3 | 80.5 | 13.7 |
| Plates30x10 | 45.0 | 07.0 | 40.0 | 08.0 |

**5-Tolerance to drought and flooding and rainy windy winter**

The survivability of the trees of was 100 % since growing till now. this reveal the survivability of trees during different environments (Table, 9)

**Table (9): Percentages of survived *A. senegalensis* trees and fruit number per tree during 1998 to 2004.**

| Season | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| % | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Fruit No. | 130 | 030 | 004 | 065 | 080 | 085 | 120 |

The survivability of trees was not affected during different seasonal and environmental changes. The yield per tree was the highest during 1998 decreased in 1999 as effect of flooding and showed a high decrease in 2000 then trees gradually increased fruits till 2004 season. The survivability of all trees and the reproduction of fruits after flooding indicate the tolerance of trees under different environments. The study by Badr (1995) indicated the full survivability of the same trees during the period from 1989 to 1997 season, passing drought periods in 1994 and stormy rainy periods .

## CONCLUSION

The *Annona senegalensis* is adopted at Alexandria region and used as pollinator and rootstock. The fruits are produced naturally without need of hand pollination but it is not used and is not commonly known. Only seeds were taken to grow new rootstocks for scientific purposes. The fruits are used for fresh consumption in its native lands. This research is conducted to study the different uses of the *A. senegalensis* under Alexandria conditions as a multiuses tree to increase income of growers and to establish its plantations in the area. The use as pollinator for other species is used only in research studies and was not used by growers, so it could help during the lack of other pollen types as it improve skin characteristics (lowering or disappearing of portuberans). It gave good results when processed to jam and accepted by panelists. The research suggested either to improve fruit qualities by pollination with good characteristic annona or if it is expensive, it would be better to use seeds in raising rootstochs or extracting natural bestisides resemble to neem oil or uses for medical purposis beside the present study uses as pollinator, processing or as tolerant rootstock. The study indicated that the *A. senegalensis* is multiuses tropical fruit tree could be profitabely grown in the coastal area with low costs and high value. More detaled researches on germination and grafting are under publishing.

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## دراسات على بعض الاستعمالات المتعددة للقشطة السنغالى كملقح وأصل وتحسين نسبه العقد وجوده الثمار. بالتلقيح

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أجريت الدراسة خلال موسمى ٢٠٠١ و ٢٠٠٢ للتركيز على الاستعمالات المتعددة للقشطة السنغالى المحدودة الانتشار فى مصر. تمت دراسه (١) الاستعمل كملقح، (٢) الاستعمال فى الصناعات التكنولوجيه مبدئيا كمربى . أجريت التلقيحات بأنواع أخرى لتلافى العيوب مثل كثره عدد البذور ونقص نسبه اللب ، (٣) الاستعمال كأصل، ،وأفضل الأوعيه لزراعة البذور لانتاج نسبه عاليه من الاصول. وأجري استكمال تقريرسايق أوضح استملرار حميع الأشجار حيه وقوة تحملهارغم تعرضها للظروف مختلفة. أظهرت النتائج زياده اللب وُورن الثمار والمواد الصلبه الكلية مما يشجع الاستعمال كملقح اضافى عند نقص اللقاح. الدراسه أوضحت امكانيه استعمال الثمار للتصنيع كمربى وتجربه منتجات أخرى فيما بعد مع الاستفادة بالبذور لانتاج أصول جديده لارتفاع نسب النجاح عند التطعيم عليها. القشطه السنغالى يلزم الاهتمام بها وتشجيع زراعتها لشدة تحملها وتعدد استعمالاتها وسهولة زراعتها وللحصول على عائد مرتفع.