

## Utilization of Some Chemicals for Synchronizing Time of Male and Female Flowers in Pecan (*Carya illionensis Koch*)

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**Abstract:** Inadequate chilling may delay normal blooming and severely reduce yield of pecan trees in subtropical regions. In the present study, hydrogen cyanamide "Dormex" 3%, potassium nitrate 5%, urea 10% and water (control) were applied to one-year-old shoots of Cherokee, Desirable, Choctaw, Cape Fear and Graking cultivars in 2006 and 2007, 4 weeks before normal bud break (1<sup>st</sup> February). Pecan buds pass through 11 growth stages and the two types of flowers (male and female) do not mature at the same time in the two seasons which defined as Dichogamy. Treatments with Dormex or potassium nitrate resulted in the least percentage of dormant and opened vegetative buds, followed by urea, meanwhile, control trees had the highest percentage. Potassium nitrate and hydrogen cyanamide treatments resulted in the highest significant percentage of female flowers and further enhanced the earlier opening of female flowers by two weeks as compared to control. Also, potassium nitrate treatment was more effective in stimulating formation of high percentage of male flowers, followed by hydrogen cyanamide then urea as compared to control. The most promising result is that application of Dormex or potassium nitrate could synchronize time of full bloom of male and female flowers within each cultivar in the two seasons. Dormex and potassium nitrate were greatly effective for increasing the initial and final fruit set percentage; meanwhile, application of urea had the least significant stimulative effect. The results of this study might be applicable to pecan growing regions with a mild winter.

**Key words:** Pecan, flowering, fruiting, urea, potassium nitrate, hydrogen cyanamide "dormex"

### INTRODUCTION

The pecan (*Carya illionensis Koch*) belongs to family *Juglandacea*, order: *Jaglandales*. It is the most important native nut grown in United States<sup>[1]</sup>. Pecan fruits are reported to be highly nutritive, they are known to contain lipids (primary oils), carbohydrates, proteins, besides Ca, P, Mg and vitamins (A and B) and volatile compounds which varies according to variety<sup>[2]</sup>. In Egypt, the total area cultivated by pecan is about 351 feddans, most of these area are concentrated in Qualubia Governorate and the yellow mountain region according to the latest statistics of the Ministry of Agriculture (2004).

Pecan trees are monoecious with the male catkins borne in lateral buds of last year's growth and female flowers borne terminally and sometimes laterally on current season's growth<sup>[3]</sup>. As rule, the two types of flowers do not mature at the same time which defined as Dichogamy, so a tree usually dose not fertilize

itself. This is fortunate because self pollination often produces smaller, poorer quality nuts and may increase pre mature drop<sup>[4]</sup>.

In areas of inadequate chilling, where low-chilling varieties may not have been planted, temperate fruit culture has depended on chemical sprays to stimulate bud burset and thus compensate for incomplete chilling<sup>[5]</sup>. The chemicals most often used are mineral oils, dinitro compounds, potassium nitrate, thiourea, cyanamides, and a mixture of cytokinin and gibberellins<sup>[3]</sup>.

Thus, the main objective of this investigation was to study the followings:

- Growth stages of pecan buds.
- Effect of some chemical treatments on opening of different bud types, the date and percentage of full bloomed flowers (female and male) and fruit set.

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## MATERIALS AND METHODS

The study was carried out on trees of five pecan cultivars (Cherokee, Desirable, Choctaw, Graking and Cape Fear) grown in the orchard of Kaha Research Station, Qualubia Governorate, Egypt. Selected trees were 31 years at the start of experiment, plotted at 5 x 10 meters apart, mostly uniform in growth and were subjected to the same conventional cultural practices.

The trees were sprayed on 1<sup>st</sup> February 2006 and 2007 with either of hydrogen cyanamid 3%, potassium nitrate 5%, urea 10% or water (control). Each treatment was composed of three trees representing three replicates. The following data were recorded for each parameter as follows:

- 30 one-year-old shoots were chosen at random on each tree, growth stages of pecan buds were recorded.
- Opening of different bud types dormant, vegetative and flower (male, female and compound which gave both male and female flowers) were calculated as percentage on the same chosen shoots.
- Date of full bloom (male and female inflorescences) were recorded on the tagged shoots.
- Fruit setting was calculated on the same tagged shoots on each tree. Total number of female flowers were recorded at full bloom, initial fruit set percentage was determined at the end of blooming and final fruit percentage was recorded at harvest.

**Statistical Analysis:** A complete randomized design in factorial experiment was used. The obtained data were subjected to analysis of variance<sup>[6]</sup> and means were compared by Duncan's multiple range test<sup>[7]</sup>.

## RESULTS AND DISCUSSION

**Growth Stages of Pecan Buds:** Pecan flower bud is a compound bud in which there are three growing points surrounded by a separate bud scale, but all enclosed within one common scale, all except the central one of these growing points are catkin buds. The male or staminate flowers are developed from lateral buds of last years growth and borne on sessile catkin inflorescence, but female or pistillate flowers appear toward the end of new shoot developed from central buds. Pecan flower bud pass through a lot of growth stages. These stages are designated in figures (1-11) as follows: 1- Dormant, 2- Outer scale split, 3- Bud swell, 4- Inner scale split, 5- Leaves appressed, 6- Early leaf expansion, 7- Leaf expansion and catkin

elongation, 8- Early pollen shed, 9- Pollen shed, 10- End of pollen shed, 11- Stigma receptivity.

Similarly, Westwood<sup>[3]</sup> recorded that pecan trees are monoecious with male catkins borne in lateral buds of last year's growth and female flowers borne terminally and some times laterally on current season's growth. Chandler<sup>[8]</sup> mentioned that pecan bud pass through a lot of growth stages and the two types of flowers do not mature at the same time which defined as Dichogamy, so a tree usually does not fertilize itself. Also, William<sup>[4]</sup> recorded different stages of bud and leaf development in pecan.

**Effect of Some Chemical Treatments on Opening of Different Bud Types:** Data shown in Tables (1 & 2) illustrate the percentages of dormant and vegetative buds as well as flower buds (male, female and compound buds).

The results indicated that control trees of all cultivars under study had significant equal percentages of dormant buds and flower buds (female and compound). However, opened male flower buds were significantly equal in all cultivars only at the second season, but at the first season Choctaw, Desirable and Cape Fear cvs. had higher percentages than Cherokee and Graking cv. As for vegetative buds, Cape Fear cv. had higher significant percentage compared with the other four cultivars under study.

Regarding the effect of different treatments on dormant buds, it was clearly noticed that water (control) and Urea applications had the highest percentage of dormant buds at the two seasons of study. It was followed by Dormex treatment, meanwhile potassium nitrate resulted in the lowest percentage without significant differences at the second season.

The interaction between chemical treatments and varieties indicated that spraying of potassium nitrate resulted in the least percentage of dormant buds, followed by Dormex then Urea. Meanwhile, control trees showed the highest percentage of dormant buds for all the cultivars under study at the two seasons of study. As for opening of vegetative buds it was noticed at the two seasons that, urea and control trees had the highest significant percentages of opened vegetative buds as compared with Dormax and potassium nitrate treatments which were significantly equal in this respect.

The percentage of opened male flower buds as presented in Tables (1&2) revealed that control trees of all cultivars under study were significantly equal at the second season. Meanwhile, Chactaw, Desirable and Graking cvs. had the highest significant percentages of opened male flower buds at the first season of study.



**1- Dormant**



**2- Outer scale split**



**3- Bud swell**



**4- Inner scale split**



**5- Leaves appressed**



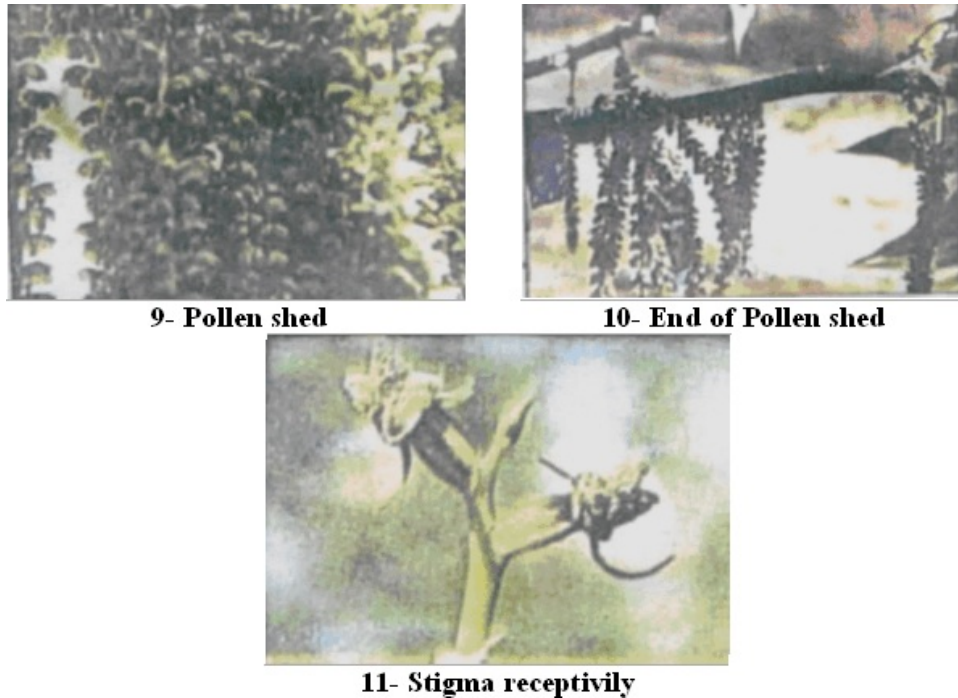
**6- Early leaf expansion**



**7- Leaf expansion and catkin elongation**



**8- Early pollen shed**



**Fig. (1-11):** Growth stages of pecan buds.

Cherooke and Cape Fear cvs. had the least significant average percentage of opened male flower buds. This trend was also ascertained in the average percentages of the aforementioned cultivars.

With respect to the effect of the treatments on opened male flower buds, it appeared that spraying of Dormex and potassium nitrate on pecan trees resulted in the highest significant percentages of opened male flower buds at the first season of study. It was followed by urea and control trees. At the second season, potassium nitrate treatment had the highest significant average of opened male flower buds. Meanwhile, Dormex and urea treatments were significantly equal to control trees.

The interaction between chemical treatments  $\times$  cultivars indicated that application of Dormex or Potassium nitrate on Cherokee, Chactaw and Graking cvs. had the highest significant effect on opening of male flower buds at first season of study. Meanwhile, either of the chemicals under study had a significant equal effect on Desirable and Cape Fear cvs. At the second season, potassium nitrate had the best effect on opening of male flower buds of Cherokee and Cape Fear cvs., while both potassium nitrate and Dormex were better for Graking cv. As for Desirable and Choctaw cvs. either of urea, potassium nitrate or Dormex had the same significant effect on opening of male flower buds.

Results of opened female flower buds are presented in Tables (1&2). Data revealed that Cherokee cv. had the highest significant average of opened female flower buds at the first season of study. It was followed by Cape Fear or Graking cvs., meanwhile Desirable or Choctaw cvs. had the least significant average percentages of opened female flower buds. At the second season, Cape Fear cv. had the highest average of opened female buds, followed by Cherokee or Graking cvs. then Desirable or Choctaw cvs. However, control trees of all the cultivars under investigation except of Cape Fear cv. at first season were significantly equal with respect to the percentage of opened female flower buds.

As for the effect of the treatments on opening of female flower buds, it appeared that potassium nitrate then Dormex treatments had the significant highest average percentage of opened female flower buds at the two seasons of study except Cape Fear cv. at the first season where all the treatments were significantly equal. Meanwhile, urea treatment was significantly equal to control trees. The interaction between chemical treatments and cultivars were in the same trend mentioned above without significant differences between treatments within each cultivar in the two seasons.

As for opening of compound flower buds results presented in Tables (1&2) revealed that, at first season,

**Table 1:** Effect of some chemical treatments on opening of different bud types (%) of pecan cvs. (2006 Season)

Vareity	Treatments	Dormant	Vegetative	Male	Female	Compound
Cherokee	Urea	10.810 b-g	61.970 ab	18.100 fg	3.866 a-d	5.251 b-e
	Dormex	7.359 f-i	42.820 cd	30.900 de	9.523 a	9.400 ab
	P. nitrate	3.479 i	47.750 bc	31.660cd	8.677a-c	8.431 a-c
	Control	12.310 a-f	66.548 a	14.680 g	4.595 a-d	1.866 de
	Average	8.490 b	54.772 a	23.840 c	6.665 a	6.237 a
Desirable	Urea	7.734 e-i	45.240 cd	41.010 a-d	2.024 d	3.986 b-e
	Dormex	10.280 b-g	31.970 d-f	44.110a-c	4.074a-d	9.573 ab
	P. nitrate	7.734 e-i	30.770 d-f	48.580ab	4.691a-d	8.223 a-c
	Control	16.170 a	42.930 cd	36.270 b-d	1.389 d	3.241 c-e
	Average	10.480 ab	37.730 bc	42.490 a	3.045 b	6.256 a
Choctaw	Urea	13.240 a-d	38.210 c-f	36.920b-d	3.086cd	8.549 a-c
	Dormex	11.640 a-g	26.350 f	48.770ab	3.872a-d	9.366 ab
	P. nitrate	8.563 d-i	26.820 ef	50.600 a	4.815a-d	9.212 ab
	Control	14.030 a-c	43.640 cd	34.490cd	1.587 d	6.261 a-d
	Average	11.870 a	33.750 c	42.690 a	3.340 b	8.347 a
Cape Fear	Urea	13.830 a-c	40.270 c-f	37.920b-d	2.732cd	5.247 b-e
	Dormex	7.979 e-i	42.450 cd	35.280cd	2.584cd	11.710 a
	P. nitrate	6.798 g-i	39.710 c-f	39.260a-d	2.245 d	11.990 a
	Control	14.240 ab	41.880 c-e	34.460cd	9.416ab	0.000 e
	Average	10.710 ab	41.080 bc	36.730ab	4.244ab	7.237 a
Graking	Urea	12.450 a-f	48.320 bc	29.360d-f	3.218b-d	6.657 a-d
	Dormex	9.009 c-h	37.140 c-f	40.030 a-d	4.531a-d	9.283 ab
	P. nitrate	4.226 hi	29.940 d-f	51.410 a	6.243 a-d	8.184 a-c
	Control	12.570 a-e	62.900 ab	19.030a-g	3.821a-d	1.675 de
	Average	9.564 ab	44.570 b	34.960 b	4.453ab	6.450 a
Mean Av.						
	Urea	11.610 A	46.800 A	32.660 b	2.985 A	5.938 B
	Dormex	9.252 B	36.150 B	39.820 a	4.917 A	9.866 A
	P. nitrate	6.160 C	34.990 B	44.300 a	5.334 A	9.209 A
	Control	13.860 A	51.581 A	27.790 B	4.162 A	2.609 C

Means with different letters within each item were significantly differed at L.S.D 0.05.

all cultivars had an equal significant average percentage of opened flower buds. Meanwhile, at second season, Cherokee and Choctaw cvs. had the highest significant average of opened compound flower buds, followed by Desirable cv. without significant differences; Graking then Cape Fear cvs. came in the next degree with

significant difference between them. However, control trees of the studied cvs. were significantly equal in this concern at both seasons.

Concerning the effect of the treatments, results indicated that Dormex and potassium nitrate had the highest significant average of opened compound flower

**Table 2:** Effect of some chemical treatments on opening of different bud types (%) of pecan cvs. (2007 Season)

Vareity	Treatments	Dormant	Vegetative	Male	Female	Compound
Cherokee	Urea	9.067 a-d	43.590 c-f	36.100 b-e	3.643 b-d	7.606 c-f
	Dormex	6.182 c-e	38.000 c-g	33.720 c-e	9.480ab	12.620 bc
	P. nitrate	4.288 de	25.110 g	45.040a-c	7.429 a-d	18.140 a
	Control	11.880ab	50.899 bc	27.610 e	2.663 d	6.948 d-h
	Average	7.853 ab	39.411 bc	35.620 b	5.804ab	11.330 a
Desirable	Urea	11.970 ab	38.090 c-g	41.690 a-d	2.161 d	6.087 e-I
	Dormex	6.806 b-e	36.230 d-g	42.150 a-d	4.055 b-d	10.760 b-f
	P. nitrate	7.870 a-e	34.210 e-g	42.690 a-d	3.704 b-d	11.530 b-d
	Control	12.690 a	40.640 c-f	39.020a-e	1.482 d	6.173 d-I
	Average	9.835 a	37.290 c	41.390ab	2.850 b	8.636 ab
Choctaw	Urea	6.553 b-e	40.160 c-f	41.400a-d	2.160 d	9.725 c-f
	Dormex	6.651 b-e	25.180 g	48.810ab	3.872 b-d	15.480 ab
	P. nitrate	5.158 c-e	25.190 g	51.780 a	6.420 a-d	11.450 b-e
	Control	9.366 a-d	46.280 b-e	34.380c-e	2.315 d	7.658 c-f
	Average	6.932 b	34.200 d	44.100 a	3.692 b	11.080 a
Cape Fear	Urea	10.580 a-c	72.854 a	8.619 f	5.826 a-d	2.121 g-I
	Dormex	4.196 de	69.317 ab	9.999 f	9.114 a-c	7.374 c-g
	P. nitrate	2.407 e	54.074 bc	26.280 e	11.770 a	5.469 f-I
	Control	10.630 a-c	53.566 bc	30.190 de	3.705b-d	1.909 hi
	Average	6.952 b	62.453 a	18.770 c	7.605 a	4.218 c
Graking	Urea	7.730 a-e	51.180 bc	31.220 de	3.218cd	6.657 d-I
	Dormex	6.657 b-e	32.800 e-g	43.390 a-d	5.924a-d	11.230 b-e
	P. nitrate	3.900 de	29.640 fg	49.790 a	6.989 a-d	9.683 c-f
	Control	8.233 a-d	60.250 b	26.920 e	3.078cd	1.522 I
	Average	6.630 b	43.470 bc	37.830ab	4.802 ab	7.273 b
Mean Av.						
	Urea	9.180 A	49.175 A	31.800 B	3.402 B	6.439 B
	Dormex	6.098 B	40.305 B	35.610 B	6.489 A	11.490 A
	P. nitrate	4.725 B	33.645 C	43.120 A	7.263 A	11.250 A
	Control	10.560 A	50.327 A	31.630 B	2.649 B	4.842 B

Means with different letters within each item were significantly differed at L.S.D 0.05.

buds at the two seasons of study, it was followed by urea application then control trees at the two seasons, but with significant difference only at the first season. This trend was mostly ascertained in the interaction (chemical × cultivars) at the two seasons with some exception in the second season where potassium nitrate was the best treatment for Cherokee cv.

Similarly, Wood<sup>[9]</sup> on pecan cv Cheyenne found that spraying hydrogen cyanamide (H<sub>2</sub>CN<sub>2</sub>) on dormant branches advanced bud break by as much as 17 days. Also, Youssef *et al.*,<sup>[10]</sup> found that (H<sub>2</sub>CN<sub>2</sub>) application was effective on bud break of Desirable pecan trees. Moreover,<sup>[11]</sup> indicated that (H<sub>2</sub>CN<sub>2</sub>) induced early, uniform and full bud break in almonds. With pistachio

**Table 3:** Effect of some chemical treatments on the date and percentage of all full bloomed female and male flowers of pecan cvs. (2006 Season).

Variety	Treatments	Female flowers		Male flowers	
		Date	Percentage	Date	Percentage
Cherokee	Urea	15/4	9.110 j	1/5	23.351 I
	Dormex	15/4	18.923 b	15/4	40.300 g
	P. nitrate	15/4	17.008 c	15/4	40.091 g
	Untreated	1/5	6.423 l	15/5	16.480 k
	Average		12.870 a		30.049 e
Desirable	Urea	15/4	6.000 lm	15/4	45.000 ef
	Dormex	1/4	14.647 d	1/4	53.683 c
	P. nitrate	15/4	12.914 g	15/4	56.803 b
	Untreated	1/5	4.630 n	1/5	39.511 g
	Average		9.547 d		48.746 b
Choctaw	Urea	1/4	11.635 h	15/4	45.469 e
	Dormex	1/4	13.238 g	1/4	57.800 ab
	P. nitrate	1/4	14.027 ef	1/4	59.812 a
	Untreated	15/4	7.848 k 11.687 b	1/5	40.751 g 50.958 a
	Average				
Cape Fear	Urea	15/4	7.979 k	15/4	43.167 f
	Dormex	1/4	14.294 d-f	1/4	46.990 e
	P. nitrate	1/4	21.406 a	1/4	51.250 d
	Untreated	15/4	2.245 o	1/5	34.460 h
	Average		11.481 b		43.967 c
Graking	Urea	1/5	9.875 i	1/5	36.017 h
	Dormex	15/4	13.814 f	15/4	49.313 d
	P. nitrate	15/4	14.427 de	15/4	59.594 a
	Untreated	1/5	5.496 m	1/5	20.705 j
	Average		10.903 c		41.410 d
Mean Av.					
	Urea		8.918 C		38.598 C
	Dormex		14.983 B		49.686 B
	P. nitrate		15.949 A		53.509 A
	Untreated		5.327 D		30.392 D

Means with different letters within each item were significantly differed at L.S.D 0.05.

trees Ahmed-aghaei cv.<sup>[12]</sup> found that spraying (H<sub>2</sub>CN<sub>2</sub>) during rest period brought forward bud break by 15 to 20 days compared with control.

As for potassium nitrate (KNO<sub>3</sub>) Wells and Dale<sup>[13]</sup> found that spraying pecan cv. Wichita with KNO<sub>3</sub> + thiourea hastened bud break. Meanwhile, this treatment did not increased bud break of pecan cv. Western Schely<sup>[14]</sup>. With pistachio Kuden *et al.*,<sup>[15]</sup> found that

KNO<sub>3</sub> was more successful in break dormancy of Ohadii floral buds then Dormex.

**Effect of Some Chemical Treatments on Date and Percentage of Full Bloomed Female and Male Flowers:** Results presented in Tables (3 & 4) revealed that control Choctaw trees had the highest significant percentage of female flowers at the two seasons. It was

**Table 4:** Effect of some chemical treatments on the date and percentage of all full bloomed female and male flowers of pecan cvs. (2007 Season).

Variety	Treatments	Female flowers		Male flowers	
		Date	Percentage	Date	Percentage
Cherokee	Urea	1/5	11.249 h	1/5	16.225 n
	Dormex	15/4	21.100 b	15/4	22.619 m
	P. nitrate	15/4	25.569 a	15/4	44.420 h
	Untreated	1/5	9.611 i	1/5	37.138 j
	Average		16.880 a		30.100 e
Desirable	Urea	15/4	8.248 j	15/4	47.777 g
	Dormex	1/4	14.815 g	1/4	52.910 e
	P. nitrate	1/4	15.234 g	1/4	54.220 d
	Untreated	1/5	7.655 j	15/4	45.193 h
	Average		11.486 d		50.026 b
Choctaw	Urea	15/4	11.885 h	15/4	51.040 f
	Dormex	1/4	19.352 c	1/4	64.290 a
	P. nitrate	1/4	17.870 d	1/4	63.230 b
	Untreated	1/5	9.967 i	1/5	42.038 I
	Average		14.772 b		55.180 a
Cape Fear	Urea	15/4	7.947 j	15/4	33.341 k
	Dormex	1/4	16.488 f	1/4	50.764 f
	P. nitrate	1/4	17.910 d	1/4	55.259 c
	Untreated	15/4	5.613 k	15/4	28.829 l
	Average		11.990 c		42.048 d
Graking	Urea	15/4	9.873 i	15/4	42.757 I
	Dormex	15/4	17.240 de	15/4	44.950 h
	P. nitrate	15/4	16.672 ef	15/4	54.723 cd
	Untreated	15/4	4.600 l	1/5	29.132 l
	Average		12.100 c		42.893 c
	Mean Av.				
	Urea		9.839 C		38.239 C
	Dormex		17.800 B		47.100 B
	P. nitrate		18.650 A		54.370 A
	Untreated		7.489 D		36.472 D

Means with different letters within each item were significantly differed at L.S.D 0.05.

significantly followed by (at the first season) or equal to (at the second season) Cherokee cv. At the first season Graking control trees produced higher percentage of female flowers than Desirable then Cape Fear cvs. with significant differences. Meanwhile, at the second season Desirable trees had higher

percentage of female flowers than Cape Fear then Graking with significant differences.

As for male flowers, data shown in Tables (3 & 4) indicated that Desirable trees produced the highest percentage of male flowers in the two seasons and it was equal or followed by Chactaw cv. They were



**Table 5:** Effect of some chemical treatments on the initial and final fruit set (%) of pecan cvs (2006/2007)

Variety	Treatments	2006 Season		2007 Season	
		Initial Set	Final Set	Initial Set	Final Set
Cherokee	Urea	11.880 fg	3.451 g	11.050 jk	6.627 g
	Dormex	35.460 a	26.540 a	39.560 a-d	32.000 ab
	P. nitrate	30.090 b	19.540 bc	31.120 ef	25.300 de
	Untreated	5.814 hi	0.9137 g	3.691 lm	1.486 h
	Average	20.810 c	12.610 a	21.350 c	16.350 b
Desirable	Urea	16.280 de	12.370 d-f	23.020 h	15.000 f
	Dormex	38.390 a	11.940 d-f	40.430 ab	35.030 a
	P. nitrate	27.780 b	11.180 ef	36.350 b-d	27.370 c-e
	Untreated	9.572 gh	2.775 g	12.710 j	3.487 gh
	Average	23.010 b	9.568 b	28.130 b	20.220 a
Choctaw	Urea	26.590 b	5.202 g	35.590 de	14.090 f
	Dormex	39.000 a	26.550 a	42.280 a	31.600 a-c
	P. nitrate	39.000 a	22.870 ab	40.310 a-c	27.800 b-d
	Untreated	7.600 hi	0.7407 g	17.810 i	4.510 gh
	Average	28.040 a	13.840 a	34.000 a	19.500 a
Cape Fear	Urea	7.125 hi	1.376 g	11.590 jk	4.128 gh
	Dormex	20.050 cd	15.820 cd	27.790 fg	18.350 f
	P. nitrate	21.850 c	15.400 c-e	29.070 fg	22.990 e
	Untreated	4.365 i	0.9167 g	5.132 lm	1.136 h
	Average	13.350 d	8.379 bc	18.400 d	11.650 c
Graking	Urea	12.770 e-g	3.989 g	7.710 kl	0.8793 h
	Dormex	22.100 c	12.310 d-f	35.700 c-e	28.360 b-d
	P. nitrate	15.740 ef	10.480 f	25.180 gh	6.437 g
	Untreated	9.093 gh	0.9997 g	2.088 m	0.8850 h
	Average	14.930 d	6.946 c	17.670 d	9.141 d
Mean Av.					
	Urea	14.930 C	5.278 C	17.790 C	8.146 C
	Dormex	31.000 A	18.630 A	37.150 A	29.070 A
	P. nitrate	26.890 B	15.900 B	32.400 B	21.980 B
	Untreated	7.289 D	1.269 D	8.287 D	2.301 D

Means with different letters within each item were significantly differed at L.S.D 0.05.

followed by Cape Fear, Graking then Cherokee cvs. in the first season, and Cherokee then Graking or Cape Fear in the second season.

Considering the date of full opened flowers on control trees, results in Tables (3 & 4) revealed that Cape Fear, Choctaw and Cherokee trees produced female flowers earlier than male flowers by two weeks

in the first season. Meanwhile, at the second season, control trees of Graking cv. produced female flowers earlier than male flowers, while Desirable trees produced male flowers earlier than female flowers by two weeks.

As for the effect of the treatments, it appeared in the two seasons (Tables 3 & 4) that potassium nitrate

and Hydrogen Cyanamide treatments resulted in the highest significant percentage of female flowers in the pecan cultivars under study, followed by urea treatment. Meanwhile, control trees had the least significant percentage of female flowers. Moreover, the hydrogen cyanamide and potassium nitrate treatments enhanced the earlier opening of female flowers by two weeks as compared to control. This was true for all cultivars under study in the two seasons. On the other side, potassium nitrate treatment was more effective in stimulating formation of high percentage of male flowers, followed by Hydrogen Cyanamide then urea as compared to control. The most promising result is that application of Dormex or potassium nitrate could synchronize time of full bloom of male and female flowers within each cultivar under study in the two seasons.

In this concern, Chandler<sup>[8]</sup> early cited that there is dichogamy in the pecan, some varieties shed nearly all their pollen before their pistils are receptive; some may not shed pollen until most of their pistils have ceased to be receptive; some are dichogamous in some years and not in others; and some shed the pollen too soon in some years or some situations, about the right time in other years, and too late in other years.

With Pistachio trees, Pontikis<sup>[16]</sup> detected that spraying female trees (cv. Aegenes) with (H<sub>2</sub>CN<sub>2</sub>) during that rest period advanced flowering by about 19 days.

Westwood<sup>[3]</sup> mentioned that H-cyanamide should not be applied less than 4 weeks before bud swell to avoid injury. Cyanamide has a marked effect on leaf buds but is also particularly useful for enhancing bloom and synchronizing time of bloom for varieties and their pollinizers. KNO<sub>3</sub> salt, if applied early enough, it has reduced the number of abnormal flowers and thus increased yield in certain peach varieties.

**Effect of Chemical Treatments on Fruit Set:** Data in Table (5) indicated that control trees of all cultivars under study had low percentages of both initial and final fruit set at the two seasons of study. However, Desirable cv. had high percentages of initial and final set in both seasons, meanwhile, Choctaw cv. had the highest percentage at only the second season compared with other cultivars under study.

As for the effect of the treatments on fruit set, it appeared that all the treatments significantly stimulated either of fruit set parameters as compared with control. However, the highest record of the initial and final fruit set was obtained by Dormex treatment, followed by potassium nitrate then urea with significant differences between them in the two seasons of study.

The interaction between chemical treatments and cultivars indicated that Dormex was greatly effective for increasing the initial and final fruit set percentage. It was significantly equal or followed by potassium nitrate treatment; meanwhile, application of urea had the least significant stimulative effect. Control trees showed the least percentages of initial and final fruit set percentages. These results were ascertained in the two seasons of study in all cultivars under investigation. Similarly, Smith *et al.*,<sup>[17]</sup> on adult pecan trees found that using various rates and timings of KNO<sub>3</sub> and urea enhanced nut size, kernel percentage and yield. Wood<sup>[9]</sup> also found that hydrogen cyanamide spray to dormant branches of pecan cv. Cheyenne at 480-960 mM, 60 days before bud break could be used commercially to advance harvesting.<sup>[18]</sup> found that air-blast foliar sprays of potassium nitrate (KNO<sub>3</sub>) plus surfactants on pecan trees enhanced nut yield.

With Almond Sharma and Dhalival<sup>[19]</sup> detected that full bloom treatment with potassium nitrate at 5 ppm, resulted in the highest fruit set in California Papershell cv. (8.25%).

With Pistachio trees Pontikis<sup>[16]</sup> found that when hydrogen cyanamide was used as a dormancy breaking agent the female trees (cv. Aegenes) produced commercial yield. Moreover,<sup>[12]</sup> on Pistachio trees indicated that treatments with hydrogen cyanamide (Dormex) and combinations of Dormex and volk oil, volk oil and potassium nitrate significantly increased yield of the treated branches.

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