



Effect of the Fluctuations of Heat on Growth, Fruiting and Yield of Some Plum Cultivars under Kalubia Governorate

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ABSTRACT

This study was carried out on three Japanese plum cultivars (*Prunus salicina* L.), namely Hollywood, Pioneer and Aspani, grafted on Marianna plum rootstock (*P. cerasifera*). Six-year-old trees planted at 4 × 4 m spacing (260 trees/Fed.) under flood irrigation at El-Kanater Research Station, Egypt, were sprayed on 23 January, 1 February, or 15 February during the 2022/2023 and 2023/2024 seasons with 0.5, 1.0, or 1.5% hydrogen cyanamide (Dormex, H₂CN₂) combined with 3% summer oil (Caple 2). Hollywood trees exhibited the earliest flowering (18–22 February), fruit set (15–16 March), and harvest (1–18 May), along with the shortest flowering and fruiting durations. Hollywood fruits also showed higher TSS and TSS/acidity ratio, lower acidity, and greater fruit number, firmness, and net income in the first season. Pioneer produced the highest yield, better flowering overlap with the other cultivars, and superior fruit number, firmness, weight, size, and economic return during the second season. Aspani recorded higher fruit set percentage and larger fruits in one season. Overall, the results indicate that Hollywood and Pioneer cultivars perform most favorably under the tested conditions. It is recommended to spray these cultivars with 1.5% Dormex + 3% Caple 2 on 15 February when trees accumulate approximately 74–109 °C ≤ 7.2 °C and 326–393 h ≤ 10 °C to achieve earlier flowering, improved fruit set, higher yield and quality, and greater economic returns.

Keywords: Plum Cultivars- Hollywood- Pioneer- Aspani Flood Irrigation- Breaking Agent.

INTRODUCTION

Many plum cultivars produce sweet fruits especially in newly reclaimed areas. According to FAO (2016) the area cultivated with plum in Egypt is 6085 Fed., in which produced about 42550 tons per year. Japanese plum is considered the main group being grown in Egypt and recognized by a distinct period of rest (endo-dormancy) which extends from late till early spring. Regrowth and flowering in the next season require overcoming such dormancy (Westwood, 1993). Fluctuation of climate affects the regrowth of plum after winter dormancy (Laure and Johnson, 1992).

Hydrogen Cyanamide (HC) is used alone or in combination with mineral oil as a rest breaking agent with many deciduous species and protect from the fluctuation of chilling and heat hours on plum (Shahin et al., 1997 and Aly et al., 1998), (Plamina et al., 1995) on peach; apricot (Shakweer, 2004, Fathi et al., 2008 and Kelany et al., 2009), apple (Sagredo et al., 2005) and pear (Maged et al., 2019). Also, Mohamed and Mohamed (2017) sprayed

Dormex at 1 % + 1.5 Caple 2 oil at 15th Feb. on Hollywood and Beauty plum cvs. and get higher fruit set, yield and fruit quality.

The aim of the present study is to assess the appropriate date and dose of spraying Dormex as a breaking agent + Caple 2 as a summer oil to overcome endo-dormancy of Hollywood, Pioneer and Aspani plum cultivars within the fluctuation of chilling and heat hours at El-Kanater Hort. Res. Station, Egypt. Rusin et al. (2022) cleared that the study examined methods to overcome bud dormancy in *Prunus salicina* 'Laetitia' plum trees grown under subtropical conditions with insufficient chilling. The authors tested mineral oil, vegetable oil, and copper sulphate as dormancy-breaking agents. Both mineral and vegetable oils significantly increased budburst and improved flowering uniformity compared with the untreated control, while copper sulphate had moderate effects. The findings highlight the potential of eco-friendly alternatives such as vegetable oils to replace conventional



chemicals like hydrogen cyanamide. The study provides useful insights for

sustainable plum production under mild winter climates

MATERIALS AND METHODS

This investigation was carried out during 2022/2023 and 2023/2024 seasons respectively at El-Kanater Hort. Res. Station, Egypt, on three Japanese plum cultivars (*Prunus salicina* L.) namely: Hollywood, Pionear and Aspani. The trees were six years old budded on Marianna plum rootstock (*P. cerasifera* L.) and planted at 4 x 4 meter apart (260 trees/fed). The trees were uniform in size, grown on clay soil under flood irrigation system. Normal Horticultural practices were adopted in accordance with the guidance of the Ministry of Agriculture of Egypt.

Table (1). Chilling hours at El-Kanater Hort. Res. Station as Central Lab. of Agric. Climate.

Spraying date	2022/2023 season		2023/2024 season	
	$\leq 7.2^{\circ}\text{C}$	$\leq 10.0^{\circ}\text{C}$	$\leq 7.2^{\circ}\text{C}$	$\leq 10.0^{\circ}\text{C}$
23 rd Jan.	10	158	27.5	159.5
1 st Feb.	16	210	40	209
15 th Feb.	109	393	74	326

Three trees were used for each treatment, one tree acts as a replicate totaling ninety trees as well as six limbs around each tree were tagged to assess the following parameters:-

- 1) Index of flowering bud activity every week.
Flower buds development stages: dormant, swelling, green tip, balloon, full bloom and fruit set. These stages were used to limit the start and end of flowering bud activity as days from bud swelling till fruit set to estimate the earliness of the studied treatments as Aly et al. (1998).
- 2) Fruit set percentage was calculated as the equation: % fruit set = No. of fruitlets x 100/No. of opened flowers as Williams (1970).
- 3) Fruit development was calculated as days from fruit set till harvest time as Zayan et al. (2016). The duration of flowering and fruit development was limited to calculate the earliness of the treatments than control (A.O.A.C., 2012).
- 4) Picking date is used to estimate crop monetary value considering the farm-gate price of LE 8 or 15/kg when Hollywood fruits were picked through May as well as LE 5 or 10 /kg when Pionear and Aspani were picked at June-Aug. of the two seasons of study. Crop monetary value =

fruit yield / tree x fruits farm – gate price (Zayan et al., 2016).

- 5) The yield fitness was assessed as the equation: yield fitness = fruit yield per tree / planting space (cm^2).
- 6) Characteristics of fruit quality: No. of fruits per tree was used to estimate fruit yield (kg/tree), fruit weight (g.), size (cm^3) and firmness (lb/inch^2) as (A.O.A.C., 2012). Also, fresh fruit juice was used to assess T.S.S. (%), titratable acidity (%) and their ratio.
- 7) Economical evaluation: the cost of chemicals, labor and constant cost (electricity for irrigation, fertilizers, pesticides and pruning) was estimated to calculate the net income of the studied treatments with consideration of the farm-gate price (LE 8000 or 15000 per ton of Hollywood cv. and LE 5000 or 10000 per ton of Pionear and Aspani cvs.) through 2023 and 2024 seasons, respectively to assess the profitability of the present treatments (Williams, 1970 and Hudson and Gregoriou, 2010).
- 8) Statistical analysis: The present study was designed in a split-split plot system with 3 factors: plum cvs. in the main plot, date of spraying in sub-plot and the dose of



spraying in sub-sub-plot. The treatments were arranged as a Randomized Complete Blocks and the collected data were statistically analyzed (except economical evaluation) according to Snedecor and

Cochran (1995). Means of treatments were compared using the LSD test at 5 % level of probability; differences among means were significantly distinguished by using letters according to Duncan, (1955).

RESULTS

1) Fruit set percentage: Table (2) revealed that, Aspani plum cv. has the highest fruit set percentages (17.08 and 17.33%) through the two seasons of study followed by Pioneer and Hollywood cvs. Besides, 1.0 % Dormex was more effective on fruit set (16.51 and 18.02 %) than 1.5 or 0.5%. Also, the present results clear that, the 3 studied plum cvs. have more fruit set percentages when sprayed at 15th Feb. (18.7 and 19.27 %) than both 2nd and 1st spray or control (7.56 and 8.33 %). The interaction between treatments fixed that, 1.01 % dose was more effective with Aspani cv. than the other 2 cvs. Meanwhile, the studied plum cvs, get higher fruit set with 1.0 % dose at 15th Feb. (the 3rd date). The differences were mostly significant.

2) Fruit yield (kg/tree): The present data (**Table 2**) cleared that, Pioneer plum cultivar get higher fruit yield (39.28 and 52.74 kg/tree) through 2023 and 2024 seasons respectively. However, Hollywood cv. get higher yield than Aspani in the 1st season while, the reverse in the 2nd one. The increase of fruit yield through the 2nd season with Pioneer and Aspani may be reflecting the good effect of the present treatments.

Spraying date at 15th Feb. (the 3rd spray) resulted in the highest yield through the two seasons of study (37.89 and 42.68 kg/tree) followed by at 1st Feb. then 23rd Jan., respectively. Spraying dose of 1.5 % Dormex get higher fruit yield (34.16 and 35.42 kg/tree) in 2023 and 2024 seasons, respectively. The interaction between plum cvs. and spraying dose showed that, Pioneer cv. get higher yield with 1.5 and 1.0 %. Moreover, 1.5 % dose induced higher yield with 3rd spraying date (15th Feb.) especially with Pioneer plum cv.

3) Yield monetary value (LE/tree): Table (3) proved that, the studied plum cvs.

through the 2nd season get much more monetary value than the 1st one may be as a result of increasing fruit yield and yield price. Moreover, Pioneer cv. get much more monetary value (LE 559.5/tree) than both Hollywood or Aspani. It is also noticeable that, spraying Dormex at 15th Feb. resulted in significant increase: in monetary value of plum fruits (LE 111.8 and 479.0/tree) followed by at 1st Feb. then at 23rd Jan., respectively while control trees get the least value through the two seasons of study (LE 44.8 and 212.9/tree). Besides, increasing Dormex spraying dose from 0.5 to 1.0 to 1.5 % gradually increased the monetary value of plum fruits especially in the 2nd season. With regard to the interaction, the 3 plum cvs. get higher monetary value with Dormex spray at 15th Feb. (LE 11.78 and 478.94/tree).

4) Yield fitness (kg/m²): Yield fitness means the fruit yield of a tree per the distance that it occupies, which reflect the efficiency of yield. However, data in **Table (3)** showed that, Pioneer plum cv. has higher fitness (2.46 and 3.30 kg/m²) than both of Hollywood (2.21 and 1.16 kg/m²) or Aspani (1.35 and 1.40 kg/m²) in 2023 and 2024 seasons respectively. Moreover, Dormex spray at 15th Feb. get higher yield fitness (2.37 and 2.67 kg/m²) followed by at 1st Feb. (2.18 and 2.03 kg/m²) and at 23rd Jan. (1.84 and 1.87 kg/m²) while control trees get the least significant fitness (1.64 and 1.24 kg/m²). Meanwhile, spraying Hydrogen. Cyanamide (H₂CN₂) at 1.5 %, significantly enhanced yield fitness (2.13 and 2.21 kg /m²) descended with at 1.0 % (2.02 and 1.92 kg/m²) during the two seasons of study, respectively. So, the highest yield fitness get from the interaction (3.43 and 4.60 kg/m²) when Pioneer cvs. sprayed with 1.5 % Dormex +3 % summer oil at 15th Feb. where



plum trees exposed to 109 or 74 hours ≤ 7.2 °C as well as 393 or 326 hours ≤ 10 °C as Central Lab. for Agric. Climate (**Table 1**).

5) Flowering and maturity duration:-

A) Flowering duration:-

Hollywood plum cv. (**Table 4 and Fig. 1**) began to flower at (22/2-12/3) and fruit set (15/3-15/4) more earlier than both Pioneer and Aspani through the 1st season and flowered at 18/2-19/3 and fruit set at 16/3-25/4 in the 2nd season which was earlier than the 1st one may be to has much more chilling requirements (Table, 1). Pioneer cv. began to flower at 3/3-20/3 and fruit set at 28/3-10/5 in 2023 season as well as flowered at 1/3- 30/3 and fruit set at 1/4-1/5 in 2024 one. Also, Aspani cv. began to flower at 18/3-10/4 and fruit set at 1/5-25/5 in the 1st season and at 21/3- 15/4 and fruit set at 5/5-28/5 in the 2nd one (**Table 4 and Fig. 1**). So we can notice good interference of the flowering duration of both Hollywood and Pioneer cvs, as well as between Pioneer and Aspani through the two seasons of study. Besides, this interference allows good cross pollination among the three plum cvs. subsequently have appropriate yield. Dormex spray date also affected the start and duration of flowering where spraying at 23rd Jan. (1st spray) get earlier flowers, duration and fruit set than 2nd or 3rd spraying dates with the present 3 plum cvs. In addition to, control trees began to flower late about 20 days with Hollywood, 17 days with Pioneer and 22 days with Aspani. That proved that, Dormex spray was effective to flowering beginning, duration and fruit set. Also, 1.5 % spraying dose was more effective than both 0.5 % and 1.0 through 2023 and 2024 seasons respectively.

B) Fruit maturity:-

Hollywood plum cultivar has gathered at 18/5-27/5 in the 1st season and at 1/5-20/5 in the 2nd one, while Pioneer cv. was harvested at 1/6-25/6 in the 1st season and at 5/6-15/6 in the 2nd one. Also, the picking date of Aspani fruits was at 1/8-15/8 in 2023 season while was at 25/7-10/8 in 2024, respectively (**Table 4 and Fig. 1**). So, Hollywood gets much income (LE 8000-15000/ton) than both Pioneer and Aspani

(LE 5000-10000/ton). Dormex spray affected harvest date to begin earlier as well as shortened the duration of harvest. The present treatments obtained 1-10 days earlier of picking date than control with Hollywood cv. and 2-7 days with Pioneer and 2-12 days with Aspani through 2023 and 2024 seasons, respectively. Moreover, 1.5% Dormex spraying dose was more effective than both 0.5 and 1.0% dose.

6) Number of fruits per tree: The present data (**Table 5**) explained that, Hollywood plum cv. obtained much more fruits in 2023 season (1512.3) than Pioneer or Aspani, while Pioneer get significant much more fruits (1310.4) than the other two cvs, in 2024 season. Furthermore, the 3rd spraying date resulted in much more fruits (1264.6 and 1033.7) followed by 2nd one (1243.7 and 813.0) then the 1st date (1031.5 and 762.7) throughout the 2 studied seasons, respectively. Much more fruits were obviously noticed after 1.5 % spraying, dose (1221.0 and 882.0) followed by 1.0 % dose (1169.9 and 780.4) and 0.5 % dose (1059.9. and 712.6), respectively. Greater fruits picked up from the interaction were the 3rd spraying date with 1.5 % dose in Hollywood cv. through 1st season but in the 2nd season Pioneer get much more fruits at 1st spraying date with 1.5 % dose. The differences between the means were mostly significant.

7) Fruit firmness (lb/inch²):- **Table (5)** proved that, fruits firmness of Pioneer cv. in the 1st season have more firmness (9.30 lb/inch²) than Aspani (9.1) or Hollywood (7.59 lb/inch²) while through the 2nd season of study Hollywood confirm higher firmness (10.07 lb/inch²) than the other 2 cvs. However, the three spraying dates involved with appropriate firmness than control. Moreover, 1.0 % and 1.5 %, dose strengthened firmer fruits than 0.5 % dose. It is obvious that, control fruits of Aspani involved with much firmer fruits with the three spraying doses in the 1st season while the 3rd spraying date of Hollywood get firmer fruits with the 3 doses in the interaction with significant differences.

8) Fruit weight (g.) and size (cm³): **Table (6)** illustrated that, Aspani has heavier



weight (36.91 g) and size (34.40 cm³) in the 1st season followed by Pioneer (29.22 g) and (28.86 cm³) then Hollywood (23.61 g and 23.86 cm³). While, through 2nd season Pioneer has higher fruit weight (39.4 g) and size (36.98 cm³) than both other cvs. Concerned with spraying date, the 3rd date (15th Feb.) resulted in heavier and bigger fruits (40.94 g. and 37.93 cm³) followed by 2nd then 1st dates. Furthermore, 1.5 % doses get heavier and larger fruits than 0.5 or 1.0 %. The interaction effect cleared that, higher fruit weight was obtained with Pioneer at 3rd date and 1.5 % dose (42.8 g.), while Hollywood resulted more sized fruits at 3rd date and 1.5 % dose (39.5 cm³).

9) Juice TSS (%): Data in **Table (7)** proved that, fruits of Hollywood induced higher T.S.S. during 2023 and 2024 seasons (13.13 and 10.36 %) than Pioneer (12.96 and 10.18 %) as well as Aspani (10.55 and 9.86 %), respectively. Concern spraying date, 15th Feb. confirms higher T.S.S. through the two studied seasons (13.34 and 10.96 %) followed by 1st Feb. then 23rd Jan. Moreover, in 2023 season 0.5 % dose resulted in higher T.S.S. (12.53 %) while the reverse was in 2024 season (9.99 %). Meanwhile, the interaction explain that, Hollywood with 3rd spray date with 1.5 % dose get higher T.S.S. (15.17 and 12.17 %).

10) Juice acidity (%): The present data (**Table 7**) explained that, fruit juice of Hollywood has the least acidity through the two seasons of study (0.585 and 0.551%) than Pioneer (0.705 and 0.567 %) or Aspani (0.793 and 0.714%), respectively. Also, 2nd spray date in 2023 (0.612%) while 3rd spray date in 2024 get lower acidity (0.560 %). Furthermore, 0.5 dose in the 1st season (0.654 %) while 1.5 dose in the 2nd season (0.591 %) have less acidity percentage. The interaction of the 1st date at 0.5 % dose affected Hollywood juice to be less acidity (0.503 %) through the 1st season while 3rd date at 1.5 % dose has lower interaction (0.457 %) in the 2nd season. Thus, higher

T.S.S. with less acidity means better taste (Westwood, 1993). In reverse, juice acidity was higher with Aspani and control treatments.

11) T.S.S. per acidity ratio: The ratios of T.S.S. per acidity (**Table 7**) confirm the interaction between T.S.S. and acidity. However, the present results strengthened the notice that Hollywood cv. has higher ratio (22.89 and 19.19) than Pioneer (18.63 and 18.15) or Aspani (14.97 and 13.94) through the two studied seasons respectively. Besides, 3rd spraying date (15th Feb.) get obvious increase in this ratio (20.5 and 20.6) than the other 2 dates, while control treatment fixed the least ratio (14.0 and 13.4). Also, 0.5 % dose involved with higher ratio (19.86) in the 1st season while 1.5 % dose obtained higher ratio (18.21) in the 2nd season, respectively. As for the interaction effect, 2nd and 3rd spraying dates at 0.5 % Dormex dose induced juice of Hollywood fruits to has higher ratio (26.92 and 27.08) in 2023 season, while 3rd date at 1.5 % dose get higher ratio (26.64) in 2024 season. So we can use this ratio as an indicator to higher T.S.S. and lower acidity. The differences between the means were mostly significant.

12) Economical evaluation: Data in **Table (8)** revealed that, Hollywood plum cv. achieved higher income in 2023 season may be as a result of higher fruit yield (9.55 ton/Fed.) and higher farm-gate price (LE 8000/ton) compared to the other 2 cvs. In reverse, through 2nd season Pioneer fixed much more income (LE 116640) than both Hollywood and Aspani may be as a reflection of higher fruit yield (15.25 ton/fed.). Furthermore, Dormex spray at 15th Feb. in both seasons of study has higher net income (LE 25785 and 103387.5) higher in reverse to at 23rd Jan. or at 1st Feb. or even control. However, 0.5 % dose resulted in higher net income (LE 27500) through 2023 season but 1.5 % dose caused better net income (LE 90850) through 2024 season.

**Table (2).** Effect of treatments on fruit set (%) and fruit yield (kg/tree).

Cultivars (A)	Spraying date (B)	Fruit set (%)			Fruit yield (kg/tree)				
		Spraying dose (%)			Mean (A x B)	Spraying dose (%)			Mean (A x B)
		0.50	1.00	1.50		0.50	1.00	1.50	
First season; 2023									
Hollywood	1 st date	14.33ij	17.50d-g	14.17j	15.33D	32.67i-k	35.17f-i	37.19ef	35.01C
	2 nd date	15.67f-j	19.33g-j	15.33g-j	16.78C	33.81g-j	37.41ef	40.79b-d	34.34C
	3 rd date	16.39f-i	18.67c-e	17.61d-f	17.56BC	35.85f-h	37.79d-f	39.99c-e	37.91B
	Control	7.00l	7.00l	7.00l	7.00E	31.50j-l	31.50j-l	31.50j-l	31.50D
Mean (A x C)		13.35EF	15.63BC	13.53EF	14.17B	33.46D	35.49C	37.37B	35.44B
Pionear	1 st date	12.13e-h	16.60e-h	16.77e-h	15.17D	35.36f-i	44.04bc	29.23lm	36.21BC
	2 nd date	15.27g-j	14.67h-j	15.3f-j	15.26D	36.73fg	43.44bc	46.00b	42.06A
	3 rd date	17.50d-g	20.17c	17.00d-g	18.22B	37.88d-f	44.48bc	54.90a	45.75A
	Control	7.67l	7.67l	7.67l	7.67E	33.10j-l	33.10j-l	33.10j-l	33.10E
Mean (A x C)		13.14F	14.78CD	14.32DE	14.08B	35.77C	41.27A	40.81A	39.28A
Aspani	1 st date	16.10f-j	23.83a	20.67bc	20.20A	15.52p	16.79op	19.31o	17.20G
	2 nd date	19.50cd	22.33ab	17.50d-g	19.78A	25.13n	20.40no	30.61j-l	25.38F
	3 rd date	19.50d-g	22.33ab	19.17cd	20.33A	26.71mn	30.05kl	33.30h-j	30.02F
	Control	8.00l	8.00l	8.00l	8.00E	14.00p	14.00p	14.00p	14.00H
Mean (A x C)		15.78B	19.12A	16.34B	17.08A	20.34F	20.31F	24.30E	21.65C
Mean Spraying date x Spraying dose (B x C)		14.19F	19.31AB	17.20DE	16.90B	29.51F	35.46D	31.50E	29.47C
		16.81DE	18.78BC	16.22E	17.27B	33.93DE	34.52D	42.58B	34.93B
		17.80CD	20.39A	17.93CD	18.70A	35.77D	40.09C	46.00A	37.89A
		7.56G	7.56G	7.56G	7.56C	28.25G	28.25G	28.28G	26.20D
Mean spraying dose (C)		14.09C	16.51A	14.73B		29.86C	32.36B	34.16A	
Second season; 2024									
Hollywood	1 st date	14.17lm	19.50d-f	14.17lm	15.95E	11.50o	14.13no	16.81l-n	14.14G
	2 nd date	15.43kl	19.10d-g	15.77j-l	16.77C-E	18.26k-m	20.60jk	24.04i	20.97D
	3 rd date	15.63kl	20.33b-e	17.20g-k	17.72BC	25.72i	29.26h	36.04g	30.34C
	Control	8.50n	8.50n	8.50n	8.50F	8.67p	8.67p	8.67p	8.67H
Mean (A x C)		13.43D	16.86B	13.91D	14.73C	16.04H	18.16G	21.39F	18.53C
Pionear	1 st date	13.00m	20.43b-e	16.33jk	16.59DE	46.75f	50.67e	73.05a	56.82B
	2 nd date	15.67kl	20.00c-e	17.17g-k	17.61B-D	51.50e	54.69d	59.95c	55.38B
	3 rd date	16.33jk	20.83b-d	18.43e-i	18.53B	51.95e	65.60b	73.56a	63.70A
	Control	8.83n	8.83n	8.83n	8.83F	35.08g	35.08g	35.08g	35.08C
Mean (A x C)		13.46D	17.52B	15.19C	15.39B	46.32C	51.51B	60.41A	52.74A
Aspani	1 st date	17.00h-k	22.17b	16.67i-k	18.61B	18.17k-m	18.50k-m	19.16kl	18.61E
	2 nd date	17.73f-j	24.17a	20.50b-e	20.83A	19.50kl	20.99jk	23.00i	21.16D
	3 rd date	18.83bc	24.00a	21.83bc	21.55A	28.15h	34.17g	39.69g	34.00B
	Control	8.33n	8.33n	8.33n	8.33F	15.99mn	15.99mn	15.99mn	15.99F
Mean (A x C)		15.50C	19.67A	16.83B	17.33A	20.45F	22.41E	24.46D	22.44B
Mean Spraying date x Spraying dose (B x C)		14.72F	20.70A	15.72EF	17.05C	25.47G	27.76F	36.34C	29.86C
		16.31DE	21.09A	17.1C	18.40B	29.75E	32.09D	35.66C	32.50B
		16.93CD	21.72A	19.15B	19.27A	35.27C	43.01B	49.76A	42.68A
		8.55G	8.55B	8.55B	8.5D	19.91H	19.91H	19.91H	19.91D
Mean spraying dose (C)		14.13C	18.02A	15.31B		27.60C	30.69B	35.42A	

The values that contain the same capital or small letter(s) in the same columns and rows indicate that there are no significant variations between each other according to Duncan's multiple range test at 5% level.

Table (3): Effect of treatments on monetary value (LE/tree) and yield fitness (kg/m²).

Cultivars (A)	Spraying date (B)	Monetary value (LE/kg/tree)				Yield fitness (kg/m2)			
		Spraying dose (%)			Mean (A x B)	Spraying dose (%)			Mean (A x B)
		0.50	1.00	1.50		0.50	1.00	1.50	
First season; 2023									
Hollywood	1 st date	114.67 ^{gh}	140.0 ^c	113.33 ^h	122.67 ^C	2.04 ⁱ	2.20 ^g	2.32 ^f	2.19 ^F
	2 nd date	125.33 ^e	154.67 ^a	122.67 ^{af}	134.22 ^B	2.11 ^h	2.34 ^e	2.55 ^d	2.33 ^D
	3 rd date	133.33 ^d	149.33 ^b	146.67 ^b	143.11 ^A	2.24 ^g	2.37 ^e	2.50 ^d	2.37 ^C
	Control	56.00 ^o	56.00 ^o	56.00 ^o	56.00 ^G	1.97 ^j	1.97 ^j	1.97 ^j	1.97 ^G
Mean (A x C)		107.33 ^B	125.00 ^A	109.67 ^B	114.0 ^A	2.09 ^D	2.22 ^C	2.34 ^B	2.21 ^B
Pioneer	1 st date	69.67 ⁿ	86.67 ^{kl}	81.67 ^{lm}	79.33 ^F	2.21 ^g	2.75 ^c	1.83 ^k	2.26 ^E
	2 nd date	76.67 ^m	85.00 ^l	79.17 ^m	80.28 ^F	2.30 ^f	2.75 ^c	2.87 ^b	2.63 ^B
	3 rd date	87.50 ^{kl}	100.00 ⁱ	85.00 ^l	90.83 ^E	2.37 ^e	2.78 ^c	3.43 ^a	2.86 ^A
	Control	38.33 ^p	38.33 ^p	38.33 ^p	38.33 ^H	2.07 ⁱ	2.07 ⁱ	2.07 ⁱ	2.07 ^G
Mean (A x C)		68.04 ^G	77.50 ^E	71.04 ^F	72.19 ^C	2.24 ^C	2.58 ^A	2.55 ^A	2.46 ^A
Aspani	1 st date	91.67 ^{jk}	119.17 ^{fg}	85.83 ^{kl}	98.89 ^D	1.97 ^p	1.05 ^o	1.21 ⁿ	1.08 ^J
	2 nd date	97.50 ⁱ	111.67 ^h	87.50 ^{kl}	98.89 ^D	1.57 ^m	1.27 ⁿ	1.91 ^j	1.59 ^I
	3 rd date	97.50 ⁱ	111.67 ^h	95.00 ^{ij}	101.39 ^D	1.67 ^l	1.88 ^{jk}	2.08 ^h	1.88 ^H
	Control	40.00 ^p	40.00 ^p	40.00 ^p	40.00 ^H	0.88 ^q	0.88 ^q	0.88 ^q	0.88 ^K
Mean (A x C)		81.67 ^D	95.63 ^C	77.08 ^E	84.79 ^B	1.27 ^F	1.27 ^F	1.52 ^E	1.35 ^C
Mean Spraying date x Spraying dose (B x C)		92.00 ^F	115.28 ^B	93.61 ^{EF}	100.30 ^C	1.74 ^G	2.00 ^E	1.79 ^F	1.84 ^C
		99.83 ^D	117.11 ^B	96.44 ^E	104.46 ^B	1.99 ^E	2.11 ^D	2.45 ^B	2.18 ^B
		106.11 ^C	120.33 ^A	108.89 ^C	111.78 ^A	2.09 ^D	2.34 ^C	2.67 ^A	2.37 ^A
Mean spraying dose (C)		44.78 ^G	44.78 ^G	44.78 ^G	44.78 ^D	1.64 ^H	1.64 ^H	1.64 ^H	1.64 ^D
Mean spraying dose (C)		85.68 ^B	99.38 ^A	85.93 ^B		1.87 ^C	2.02 ^B	2.13 ^A	
Second season; 2024									
Hollywood	1 st date	172.50 ^w	210.50 ^t	252.50 ^r	211.83 ^H	0.72 ^s	0.88 ^r	1.05 ^q	0.88 ^J
	2 nd date	274.50 ^q	309.00 ^o	360.01 ⁱ	314.50 ^G	1.14 ^p	1.29 ^{no}	1.50 ^m	1.31 ^G
	3 rd date	385.50 ^k	439.0 ⁱ	541.00 ^e	455.17 ^D	1.61 ^l	1.83 ^k	2.25 ⁱ	1.90 ^F
	Control	130.50 ^y	130.50 ^y	130.50 ^y	130.50 ^K	0.54 ^t	0.54 ^t	0.54 ^t	0.54 ^K
Mean (A x C)		240.75 ^G	272.25 ^E	321.00 ^D	278.0 ^B	1.00 ^I	1.14 ^H	1.34 ^F	1.16 ^C
Pioneer	1 st date	467.33 ^h	506.67 ^g	731.00 ^a	568.33 ^B	2.92 ^f	3.17 ^e	4.57 ^a	3.55 ^B
	2 nd date	515.33 ^f	547.67 ^d	600.00 ^c	554.33 ^C	3.22 ^{de}	3.42 ^d	3.75 ^c	3.46 ^C
	3 rd date	520.0 ^f	656.00 ^b	735.67 ^a	637.22 ^A	3.25 ^e	4.10 ^b	4.60 ^a	3.98 ^A
	Control	348.33 ^m	348.33 ^m	348.33 ^m	348.33 ^E	2.19 ^{ij}	2.19 ^{ij}	2.19 ^{ij}	2.19 ^D
Mean (A x C)		462.75 ^C	514.67 ^B	603.75 ^A	527.06 ^A	2.89 ^C	3.22 ^B	3.78 ^A	3.30 ^A
Aspani	1 st date	181.67 ^v	185.00 ^v	191.67 ^u	186.11 ^I	1.13 ^p	1.16 ^p	1.20 ^p	1.16 ^H
	2 nd date	185.0 ^u	210.0 ^t	230.0 ^s	211.67 ^H	1.22 ^{op}	1.31 ⁿ	1.44 ^m	1.32 ^G
	3 rd date	295.0 ^p	341.67 ⁿ	396.67 ^j	344.44 ^F	1.76 ^k	2.14 ^j	2.4 ^h	2.13 ^E
	Control	160.00 ^x	160.00 ^x	160.00 ^x	160.00 ^J	1.00 ^q	1.00 ^q	1.00 ^q	1.00 ^I
Mean (A x C)		207.92 ^I	224.17 ^H	244.58 ^F	225.56 ^C	1.28 ^G	1.40 ^E	1.53 ^D	1.40 ^B
Mean Spraying date x Spraying dose (B x C)		273.83 ^I	300.72 ^H	391.72 ^E	322.09 ^C	1.59 ^I	1.74 ^H	2.27 ^C	1.87 ^C
		328.28 ^G	355.56 ^F	396.67 ^D	360.17 ^B	1.86 ^G	2.01 ^E	2.23 ^D	2.03 ^B
		400.17 ^C	478.89 ^B	557.78 ^A	478.94 ^A	2.20 ^D	2.69 ^B	3.11 ^A	2.67 ^A
Mean spraying dose (C)		212.94 ^J	212.94 ^J	212.94 ^J	212.94 ^D	1.24 ^F	1.24 ^F	1.24 ^F	1.24 ^D
Mean spraying dose (C)		303.81 ^C	337.03 ^B	389.78 ^A		1.73 ^C	1.92 ^B	2.21 ^A	

The values that contain the same capital or small letter(s) in the same columns and rows indicate that there are no significant variations between each other according to Duncan's multiple range test at 5% level.



Table (4): Effect of spraying date and spraying dose on flowering and maturity date during 2023 and 2024.

Cultivars (A)	Spraying date (B)	Spraying dose (%)	First season; 2023						Second season; 2024					
			Flowering date			Maturity date			Flowering date			Maturity date		
			Start	Fruit set	Duration	Harvest date	Duration	Earliness than control (day)	Start	Fruit set	Duration	Harvest date	Duration	Earliness than control (day)
Hollywood	1 st date	0.50	28/2	25/3	27	20/5	60	-	21/2	19/3	28	1/5	41	4
		1.00	26/2	25/3	29	18/5	53	2	21/2	19/3	28	1/5	41	4
		1.50	22/2	15/3	23	18/5	63	-	18/2	16/3	28	1/5	44	1
	2 nd date	0.50	5/3	5/4	30	25/5	55	-	28/2	1/4	32	10/5	40	5
		1.00	3/3	30/3	27	23/5	53	2	25/2	1/4	32	10/5	40	5
		1.50	28/2	25/3	27	20/5	55	-	28/2	28/3	33	5/5	37	8
	3 rd date	0.50	7/3	5/4	28	27/5	52	3	10/3	13/4	33	20/5	37	8
		1.00	5/3	5/4	30	25/5	50	5	10/3	13/4	33	20/5	37	8
		1.50	3/3	1/4	28	25/5	55	-	6/3	10/4	34	15/5	35	10
	Control		12/3	15/4	33	10/6	55	-	19/3	25/4	36	10/6	45	-
Pioneer	1 st date	0.50	5/3	5/4	30	18/6	73	7	6/3	16/4	30	5/6	59	6
		1.00	3/3	1/4	28	18/6	78	2	6/3	6/4	30	5/6	59	6
		1.50	3/3	28/3	25	1/6	80	-	1/3	1/4	30	5/6	65	-
	2 nd date	0.50	9/3	10/4	31	23/6	73	7	10/3	10/4	30	15/6	65	-
		1.00	7/3	7/4	30	20/6	73	7	10/3	10/4	30	15/6	65	-
		1.50	5/3	5/4	30	20/6	75	5	6/3	5/4	29	15/6	70	-
	3 rd date	0.50	9/3	12/4	33	25/6	73	7	10/3	10/4	30	10/6	60	5
		1.00	7/3	9/4	32	23/6	74	6	10/3	10/4	30	10/6	60	5
		1.50	5/3	5/4	30	23/6	78	2	6/3	4/4	28	5/6	61	4
	Control		20/3	10/5	50	30/7	80	-	30/3	1/5	30	5/7	65	-
Aspani	1 st date	0.50	25/3	8/5	43	1/8	83	12	30/3	10/5	40	30/7	80	12
		1.00	21/3	8/5	47	1/8	83	12	30/3	10/5	40	30/7	80	12
		1.50	18/3	1/5	42	1/8	90	5	21/3	5/5	44	25/7	80	12
	2 nd date	0.50	25/3	8/5	43	10/8	92	3	30/3	10/5	40	1/8	80	12
		1.00	21/3	8/5	47	10/8	92	3	30/3	10/5	40	1/8	80	12
		1.50	18/3	1/5	42	5/8	95	-	25/3	5/5	40	1/8	85	12
	3 rd date	0.50	30/3	1/5	30	15/8	95	-	30/3	10/5	40	10/8	90	2
		1.00	28/3	1/5	32	15/8	95	-	30/3	10/5	40	10/8	90	2
		1.50	25/3	25/4	30	10/8	105	-	25/3	8/5	43	10/8	92	-
	Control		10/4	25/5	45	30/8	95	-	15/4	28/4	43	1/9	92	-



Fig. (1). Plum fruits from fruit set till harvest date.

**Table (5).** Effect of treatments on No. of fruit/tree and firmness (lb/inch²).

Cultivars (A)	Spraying date (B)	No. of fruits/tree			Firmness lb/inch ²				
		Spraying dose (%)			Mean (A x B)	Spraying dose (%)			
		0.50	1.00	1.50		0.50	1.00	1.50	Mean (A x B)
First season; 2023									
Hollywood	1 st date	1291.3n	1494.7g	1643.3d	1476.4D	7.00m	7.70i-k	7.67jk	7.46I
	2 nd date	1463.7h	1624.3e	1821.0b	1636.3B	7.50kl	7.87ij	7.87ij	7.74H
	3 rd date	1508.3f	1684.0c	1874.7a	1689.0A	7.53kl	7.90i	7.80ij	7.74H
	Control	1248.3o	1248.3o	1248.3o	1248.3C	7.43l	7.43l	7.43l	7.43I
Mean (A x C)		1377.9E	1512.8B	1646.8A	1512.3A	7.37F	7.73E	7.69E	7.59C
Pioneer	1 st date	1066.0r	1386.3k	1078.7q	1177.0H	8.87fg	9.30cd	9.23cd	9.13D
	2 nd date	1152.0p	1419.7i	1614.0e	1395.2E	8.83fg	9.50b	9.23cd	9.19D
	3 rd date	1305.0m	1398.7j	1343.3l	1349.0F	8.97ef	9.53b	9.40bc	9.30C
	Control	1506.7fg	1506.7fg	1506.7fg	1506.7C	9.57b	9.57b	9.57b	9.57B
Mean (A x C)		1257.4F	1427.8C	1385.7D	1357.0B	9.06C	9.48A	9.36B	9.30A
Aspani	1 st date	416.2y	400.0z	507.0x	441.1K	8.17h	8.93e-g	8.73g	8.61F
	2 nd date	655.1w	689.1u	754.6t	699.6J	6.13n	8.87fg	8.77fg	7.92G
	3 rd date	677.4v	758.2t	831.8s	755.8I	8.77fg	9.10de	8.87fg	8.91E
	Control	426.6y	428.6y	728.6y	428.6L	10.97a	10.97a	10.97a	10.97A
Mean (A x C)		544.3I	569.0H	630.5G	581.3C	8.51D	9.47A	9.33B	9.10B
Mean Spraying date x Spraying dose (B x C)		924.5I	1093.7F	1076.3G	1031.5D	8.01G	8.64C-E	8.54E	8.40C
		1090.2F	1244.4D	1396.5A	1243.7B	7.49H	8.74BC	8.62DE	8.29D
		1163.6E	1280.3C	1349.9B	1264.6A	8.42F	8.84B	8.69CD	8.65B
		1061.2H	1061.2H	1061.2H	1061.2C	9.32A	9.32A	9.32A	9.32A
Mean spraying dose (C)		1059.9C	1169.9B	1221.0A		8.31C	8.89A	8.79B	
Second season; 2024									
Hollywood	1 st date	330.7y	395.0x	449.0v	391.6K	9.40j	9.77gh	10.30f	9.82G
	2 nd date	477.7u	537.0r	620.0p	544.9G	9.77gh	9.80g	10.30f	9.96F
	3 rd date	651.7o	745.0m	870.0k	755.6F	11.10c	11.27b	12.23a	11.53A
	Control	263.7z	263.7z	263.7z	263.7L	8.97k	8.97k	8.97k	8.97J
Mean (A x C)		430.9I	485.2H	550.7F	488.9C	9.1CD	9.95B	10.45A	10.07A
Pioneer	1 st date	1177.7i	1251.0h	1773.0a	1400.6B	9.37j	9.70gh	9.83g	9.63H
	2 nd date	1278.0f	1352.7e	1437.7d	1356.1C	9.77gh	10.33ef	10.67d	10.26D
	3 rd date	1267.0g	1546.0c	1718.7b	1510.6A	10.33ef	10.33ef	10.50de	10.39C
	Control	974.3j	974.3j	974.3j	974.3D	9.00k	9.00k	9.00k	9.00J
Mean (A x C)		1174.3C	1281.0B	1475.9A	1310.4A	9.62E	9.84C	10.00B	9.82B
Aspani	1 st date	490.7t	492.0t	505.7s	496.1I	9.00k	9.50ij	9.50ij	9.33I
	2 nd date	506.0s	532.7r	575.3q	538.0H	9.60hi	10.17f	10.50de	10.09E
	3 rd date	697.3n	839.0l	968.7j	835.0E	10.17f	10.67d	11.33b	10.72B
	Control	437.0w	737.0w	737.0w	437.0J	8.67l	8.67l	8.67l	8.67K
Mean (A x C)		532.8G	575.2E	621.7D	576.5B	9.36F	9.75D	10.00B	9.70C
Mean Spraying date x Spraying dose (B x C)		666.3H	712.7G	909.2C	762.7C	9.26G	9.66F	9.88E	9.60C
		753.9F	807.4E	877.7D	813.0B	9.71F	10.10D	10.49C	10.10B
		872.0D	1043.3B	1185.8A	1033.7A	10.53C	10.76B	11.36A	10.88A
		558.3I	558.3I	558.3I	558.3D	8.88H	8.88H	8.88H	8.88D
Mean spraying dose (C)		712.6C	780.4B	882.A		9.59C	9.85B	10.15A	

The values that contain the same capital or small letter(s) in the same columns and rows indicate that there are no significant variations between each other according to Duncan's multiple range test at 5% level.

**Table (6).** Effect of treatments on fruit weight (g) and size (cm³).

Cultivars (A)	Spraying date (B)	Fruit weight (g)			Mean (A x B)	Fruit size (cm ³)			Mean (A x B)
		Spraying dose (%)				Spraying dose (%)			
		0.50	1.00	1.50		0.50	1.00	1.50	
First season; 2023									
Hollywood	1 st date	25.30l	23.53mn	22.63n-p	23.82H	25.90gh	23.90i	23.23ij	24.34I
	2 nd date	23.10m-o	23.03m-o	22.40op	22.84I	23.23ij	23.57i	22.43j	23.08J
	3 rd date	23.77m	22.50op	21.33q	22.53I	23.80i	22.83ij	21.33k	22.66J
	Control	25.23l	25.23l	25.23l	25.23G	25.37h	25.37h	25.37h	25.37H
Mean (A x C)		24.35F	23.57G	22.90H	23.61C	24.58F	23.92G	23.09H	23.86C
Pioneer	1 st date	33.17f	31.77g	27.10k	30.68F	22.90ij	31.80de	26.80g	27.10G
	2 nd date	31.89g	30.60h	28.50j	30.33F	32.50d	31.23e	28.93f	30.89E
	3 rd date	29.03ij	31.80g	40.87b	33.90D	29.27f	32.07de	39.17ab	33.50D
	Control	21.97pq	21.97pq	21.97pq	21.97J	23.97i	23.97i	23.97i	23.97I
Mean (A x C)		29.01E	29.04E	29.61D	29.22B	27.16E	29.72D	29.72D	28.86B
Aspani	1 st date	37.28e	41.96a	38.08de	39.11B	35.23c	38.83ab	35.77c	36.61B
	2 nd date	38.37d	29.60i	40.57b	36.18C	35.33c	39.83a	38.33b	37.83A
	3 rd date	39.43c	39.63c	40.03bc	39.70A	38.50b	26.00gh	38.33b	34.28C
	Control	32.67fg	32.67fg	32.67fg	32.67E	28.87f	28.87f	28.87f	28.87F
Mean (A x C)		36.94B	35.97C	37.84A	36.91A	34.48B	33.38C	35.33A	34.40A
Mean Spraying date x Spraying dose (B x C)		31.62C	32.42B	29.27G	31.20B	28.01F	31.44B	28.60E	29.35C
		31.12DE	27.74H	30.49F	29.78C	30.36CD	31.54B	29.90D	30.60A
		30.74EF	31.31D	34.08A	32.04A	30.52C	26.97G	32.94A	30.14B
		26.62I	26.62I	26.62I	26.62D	26.07H	26.07H	26.07H	26.07D
Mean spraying dose (C)		30.10A	29.52B	30.12A		28.74B	29.01B	29.38A	
Second season; 2024									
Hollywood	1 st date	34.77r	35.77q	37.43mn	35.99H	32.00mn	35.00jk	35.50h-j	34.17F
	2 nd date	38.23j-l	38.37jk	37.77ij	38.46E	35.50h-j	36.83ef	38.00cd	36.78D
	3 rd date	39.47hi	39.27hi	41.43bc	40.06C	38.17b-d	37.3cd	39.50a	38.50A
	Control	32.87s	32.87s	32.87s	32.87I	31.33n	31.33n	31.33n	31.33G
Mean (A x C)		36.34G	36.57G	37.63F	36.84C	34.25F	35.25D	36.08C	35.19B
Pioneer	1 st date	39.70gh	40.50d-f	41.20b-d	40.47B	36.70e-g	38.83ab	38.57bc	38.03B
	2 nd date	40.30e-g	40.43d-g	41.70b	40.81B	35.83h-j	36.33f-h	37.00ef	36.39D
	3 rd date	41.00b-e	42.43a	42.80a	42.08A	38.33bc	37.33de	37.3cd	37.83BC
	Control	36.00pq	36.00pq	36.00pq	36.00H	35.67h-j	35.67h-j	35.67h-j	35.67E
Mean (A x C)		39.25C	39.84B	40.43A	39.4A	36.63B	37.04A	37.27A	36.98A
Aspani	1 st date	37.00no	37.60l-n	37.90k-m	37.50F	32.67m	34.00l	34.67kl	33.78F
	2 nd date	38.53jk	39.40hi	39.97f-h	39.30D	35.33i-k	36.00g-i	36.33f-h	35.89E
	3 rd date	40.37e-g	40.73e-g	40.97b-e	40.69B	37.00ef	37.33de	3.00cd	37.44C
	Control	36.60op	36.60op	36.60op	36.60G	30.40o	30.40o	30.40o	30.40H
Mean (A x C)		38.13E	38.58D	38.86D	38.52B	33.85G	34.43F	34.85E	34.38C
Mean Spraying date x Spraying dose (B x C)		37.16G	37.96F	38.84E	37.99C	33.79F	35.94DE	36.24D	35.33C
		39.02DE	39.40D	40.15C	39.52B	35.56E	36.39D	37.11C	36.35B
		40.2C	40.81B	41.73A	40.94A	37.83B	37.50BC	38.44A	37.93A
		35.16H	35.16H	35.16H	35.16D	32.47G	32.47G	32.47G	32.47D
Mean spraying dose (C)		37.90C	38.33B	38.97A		34.91C	35.38B	36.07A	

The values that contain the same capital or small letter(s) in the same columns and rows indicate that there are no significant variations between each other according to Duncan's multiple range test at 5% level.

**Table (7).** Effect of treatments on fruit juice TSS (%), acidity and TSS/acid ratio.

Cultivars (A)	Spraying date (B)	TSS (%)				Acidity (%)				TSS/acidity ratio			
		Spraying dose (%)			Mean (A x B)	Spraying dose (%)			Mean (A x B)	Spraying dose (%)			Mean (A x B)
		0.50	1.00	1.50		0.50	1.00	1.50		0.50	1.00	1.50	
First season; 2023													
Hollywood	1st date	13.33f	12.67h-j	12.50ij	12.83D	0.503k	0.520jk	0.543jk	0.522G	26.49a	24.36b	23.01c	24.62
	2nd date	14.27cd	13.17fg	13.00f-h	13.4C	0.530jk	0.527jk	0.533jk	0.530G	26.92a	25.00b	24.38b	25.43
	3rd date	15.17a	14.50bc	14.00de	14.56A	0.560i-k	0.577h-j	0.633e-h	0.590F	27.08a	25.14b	22.11d	24.78
	Control	11.67kl	11.67kl	11.67kl	11.67G	0.697cd	0.697cd	0.697cd	0.697E	16.75j-l	16.75j-l	16.75j-l	16.75
Mean (A x C)		13.61A	13.00C	12.79DE	13.13A	0.573E	0.50DE	0.602D	0.585C	24.31A	22.81B	21.56C	22.89A
Pioneer	1st date	13.83e	13.33f	13.00f-h	13.39C	0.650d-g	0.667d-g	0.653d-g	0.657E	21.28de	20.00f	19.90f	20.39
	2nd date	12.83g-i	12.50ij	12.33j	12.56E	0.610g-i	0.650d-g	0.660d-g	0.640E	21.04e	19.23fg	18.69gh	19.65
	3rd date	14.67b	13.67e	13.33f	13.89B	0.667d-g	0.693c-e	0.750bc	0.703C	22.00d	19.71f	17.78hi	19.83
	Control	12.00k	12.00k	12.00k	12.00F	0.820a	0.820a	0.820a	0.820B	14.63m	14.63m	14.63m	14.63
Mean (A x C)		13.33B	12.88CD	12.67E	12.96B	0.687C	0.708B	0.721BC	0.705B	19.74D	18.39E	17.75F	18.63B
Aspani	1st date	10.80op	10.43q	11.00no	10.74H	0.680d-f	0.633e-h	0.683d-f	0.666DE	15.88l	16.47j-l	16.10kl	16.15
	2nd date	10.60pq	10.83op	10.67o-q	10.70H	0.617gh	0.753b	0.627f-h	0.666DE	17.19ij	14.38m	17.02i-k	16.20
	3rd date	12.00k	11.50lm	11.27mn	11.59G	0.650d-g	0.750bc	0.667d-g	0.689CD	18.46fg	15.33l	16.90ij	16.90
	Control	9.17r	9.17r	9.17r	9.17I	0.863a	0.863a	0.863a	0.863A	10.62n	10.62n	10.62n	10.62
Mean (A x C)		10.64F	10.48F	10.53F	10.55C	0.703BC	0.750A	0.710BC	0.721A	15.54G	14.20H	15.16G	14.97C
Mean Spraying date x Spraying dose (B x C)		12.66D	12.14E	12.17E	12.32B	0.611DE	0.607DE	0.627CD	0.615C	21.22C	20.28DE	19.67EF	20.39B
		12.57D	12.17E	12.00E	12.24B	0.586E	0.643C	0.607DE	0.612C	21.72B	19.54FG	20.03D-F	20.43AB
		13.94A	13.22B	12.87C	13.34A	0.626CD	0.673B	0.683B	0.661B	22.51A	20.06G	18.93G	20.50A
		10.94F	10.94F	10.94F	10.94C	0.793A	0.793A	0.793A	0.793A	14.00H	14.00H	14.00H	14.00C
Mean spraying dose (C)		12.53A	12.12B	11.99C		0.654B	0.679A	0.678A		19.86A	18.47B	18.16C	
Second season; 2024													
Hollywood	1st date	9.67i	10.17h	10.17h	10.00D	0.567g	0.517ij	0.500j	0.528H	17.06j	19.68ef	20.33e	19.02
	2nd date	10.73d-f	10.53fg	10.93c-e	10.73B	0.563gh	0.530h-j	0.500j	0.531H	19.05fg	19.87e	21.87c	20.26
	3rd date	11.17bc	11.33b	12.17a	11.56A	0.530h-j	0.510j	0.457k	0.499I	21.07d	22.22c	26.64a	23.31
	Control	9.17kl	9.17kl	9.17kl	9.17F	0.647de	0.647de	0.647de	0.647D	14.18mn	14.18mn	14.18mn	14.18
Mean (A x C)		10.1B-D	10.30B	10.61A	10.36A	0.577CD	0.551E	0.526F	0.551C	17.84C	18.99B	20.75A	19.19A
Pioneer	1st date	10.17h	10.33gh	10.50fg	10.33C	0.586fg	0.577g	0.561gh	0.575F	17.35ij	17.92hi	18.72gh	17.99
	2nd date	11.17bc	10.17h	10.50fg	10.61B	0.588fg	0.553g-i	0.522ij	0.554G	19.00fg	18.40gh	20.13e	19.18
	3rd date	10.33gh	10.50fg	11.00cd	10.61B	0.562gh	0.528h-j	0.463k	0.518H	18.38gh	19.87e	23.74b	20.66
	Control	9.17kl	9.17kl	9.17kl	9.17F	0.620ef	0.620ef	0.620ef	0.620E	14.78lm	14.78lm	14.78lm	14.78
Mean (A x C)		10.21BC	10.04D	10.29B	10.18B	0.589C	0.569D	0.542EF	0.567B	17.3D	17.74CD	19.34B	18.15B
Aspani	1st date	9.33gh	9.50ij	9.67i	9.50E	0.733b	0.700c	0.700c	0.711B	12.73o	13.57n	13.81n	13.37
	2nd date	9.67i	10.33gh	10.67ef	10.22C	0.700c	0.680cd	0.673cd	0.684C	13.81n	15.20kl	15.84k	14.95
	3rd date	10.33gh	10.67ef	11.17bc	10.72B	0.667cd	0.673cd	0.647de	0.662D	15.50kl	15.84k	17.27ij	16.20
	Control	9.00l	9.00l	9.00l	9.00G	0.800a	0.800a	0.800a	0.800A	11.25p	11.25p	11.25p	11.25
Mean (A x C)		9.58F	9.88E	10.13CD	9.86C	0.725A	0.713AB	0.705B	0.714A	13.32G	13.96F	14.54E	13.94C
Mean Spraying date x Spraying dose (B x C)		9.72G	10.00F	10.11F	9.94C	0.629B	0.598C	0.587CD	0.604B	15.71G	17.06F	17.62DE	16.80C
		10.52D	10.34E	10.70BC	10.52B	0.617B	0.588CD	0.565E	0.590C	17.29EF	17.82D	19.28B	18.13B
		10.61CD	10.83B	11.44A	10.96A	0.586CD	0.5714DE	0.522F	0.560D	18.31C	19.31B	22.55A	20.06A
Mean spraying dose (C)		9.11H	9.11H	9.11H	9.11D	0.689A	0.689A	0.689A	0.689A	13.40H	13.40H	13.40H	13.40D
		9.99C	10.07B	10.34A		0.630A	0.611B	0.591C		16.18C	16.90B	18.21A	

The values that contain the same capital or small letter(s) in the same columns and rows indicate that there are no significant variations between each other according to Duncan's multiple range test at 5% level.



Table (8): Effect of treatments on economical evaluation of plum cvs. during 2023 and 2024

Treatments		Chemicals cost (LE/fed.)	Chemical+ labor cost (LE/fed.)	Total cost (LE/fed.)	Fruit yield (ton/fed.)	Farm gate price (LE/fed.)	Yield value (LE/ton)	Net income (LE)
First season; 2023								
Spraying dose (%)	0.50	24150	28650	31650	9.10	6500	59150	27500
	1.00	29400	32900	35900	8.93	6500	58045	22145
	1.50	34650	38150	41150	9.86	6500	64090	22940
Spraying date	1 st date	29400	32900	35900	8.01	6500	52065	16165
	2 nd date	29400	32900	35900	9.17	6500	59605	23705
	3 rd date	29400	32900	35900	9.49	6500	61685	25785
Plum cvs.	Hollywood	29400	32900	35900	9.55	8000	76400	40500
	Pioneer	29400	32900	35900	10.60	5020	53000	17100
	Aspani	29400	32900	35900	6.52	5000	32600	-3300
Control		-	3500	6500	6.63	6500	43095	36595
Second season; 2024								
Spraying dose (%)	0.50	24150	28650	31650	7.219	12500	90237.5	58587.5
	1.00	29400	32900	35900	8.920	12500	111500	15600
	1.50	34650	38150	41150	10.560	12500	132000	90850
Spraying date	1 st date	29400	32900	35900	7.763	12500	97037.5	61137.5
	2 nd date	29400	32900	35900	8.457	12500	105712.5	69812.5
	3 rd date	29400	32900	35900	11.143	12500	139287.5	103387.5
Plum cvs.	Hollywood	29400	32900	35900	5.673	15000	85095	49195
	Pioneer	29400	32900	35900	15.254	10000	152540	116640
	Aspani	29400	32900	35900	6.436	10000	64360	28460
Control		-	3500	6500	5.157	12500	64462.5	57962.5



DISCUSSION

The present results fixed that, Hollywood, Pioneer and Aspani plum cultivars, positively responded to the studied endo-dormancy breaking agent (H_2CN_2) with 0.5, 1.0 and 1.5 % + 3 %, summer oil (Caple 2) at 23rd Jan., 1st Feb. and 15th Feb. when the trees have sufficient chilling requirements (**Table 1**). Hence, the studied treatments effectively accelerated dates of flowering, fruit set and picking date. Meanwhile, the present treatments increased fruit set percentage, fruit yield (kg/tree and ton/Fed.), monetary value (LE/tree), yield fitness (kg/m²), number of fruits/tree, fruit firmness (lb/inch²), fruit weight (g.) and size (cm²), T.S.S.(%), T.S.S./acidity ratio as well as the grower net income (LE) while decreased acidity (%) than control.

Furthermore, many investigators used dormancy breaking agents, since 1984 Hydrogen Cyanamid began to be used commercially to complete and synchronize bud breaking in (Larue and Johnson, 1992 and Plamina et al., 1995). Increase bud burst to highest percentages, uniform bud breaking to concentrate flowering and harvest. Hasten bud break of a cultivar to achieve improved cross pollination. HC is used in Latin America on: apple, cherry, plum, fig, pear, peach and kaki. Local researches have come up with specific recommendations regarding dosage and time of application (Behnke, 1992). Some regions do not provide adequate chilling for growing plum trees and apple necessitating using

artificial means to break dormancy (HC) alone or in combination with mineral oil (Mansour et al., 1999, Sagredo et al., 2005, Mahrous and El-Fakharani 2006, Hudson and Gregoriou, 2010 and Maged et al., 2019). However, these factors vary with variety and climatic zone. Also, Shakweer (2004) sprayed HC + mineral oil which increased “Canino” apricot flower buds opening, advanced flowering, fruit set and fruit yield; as well as Fathi et al., (2008) concluded that, the best treatment at 3 % Dormex + 3 % Capl 2 oil which sprayed at 9th Feb. To attained early production and higher yield with good fruit quality and increased the grower income.

Meanwhile, 1.5 %, dose of HC + 3 %, Capl 2 sprayed at 15th Feb. after 74-109 °C ≤ 7.2 °C (**Table 1**) get the best results in the present study. Also, Ramina et al., (1995) showed that, t-zealin riboside which remained low through the rest period, increased at bud swelling of peach which corresponded positively with the increase in chilling units. Besides, Aly et al., (1998); Mohamed and Mohamed (2017) sprayed Dormix at 1.0 % + 1.5 % Capl 2 oil at 15th Feb. on Hollywood and Beauty plum cultivars under fluctuations of chilling and heat hours and get higher fruit set percentage and yield as well as earlier fruit set (17-21 days) than control and no agent residues were found in fruits after 110 days of application.

REFERENCES

- Aly, M.M., Kabeel, H. and Eliwa, G.I. (1998). Effect of some dormancy breaking treatments on some plum cultivars in Giza and Kalyabia governorates. J. Agric. Sci. Mansora Univ., 23(7):3301 -3316.
- A.O.A.C. (2012). Official methods of analysis. Pp. 832-849. USA.
- Bailey, G.H.; Kotowaki, S. and Hough, L.F. (1982). Estimate of chilling requirements of apricot selections II. Acta Hort, 121: 9-102.
- Behnke, H. (1992). Experience with the application of Hydrogen Cyanamide on fruit trees in Latin America, 10. 17660/Acta Hort. 1992.310.10.
- Duncan, D. B. (1955). Multiple range and multiple F tests. Biometrics, 11(1): 1-42.
- Fathi, M.A.; Hussein, S.M. and Eman A. Kandil (2008). Effect of some Endo-dormancy breaking agents on flowering, yield and fruit quality of “Canino” apricot. Egypt. J. Appl. Agric. Res., 1(2): 211-223.
- FAO (2016). Food and Agric. Organ, of United Nations, Agric. Statistics. www.Fao.Org.Spt.



- Hudson, R. and Gregoriou, A. (2010).** Calculating and comparing security returns is harder than you think: A comparison between logarithmic and simple returns. SSRN, SSRN, 1549328.
- Kelany, A.E.; Fayed, T.A.; El-Fakhrani, E.M. and Sayed, S.N. (2009).** Effect of some dormancy breaking agents on bud behaviour, vegetative growth, fruit set and yield of "Canino" apricot. J. Agric. Sci. Mansoura Univ. 34(5): 4861-4871.
- Larue, J.H. and Johnson, R.S. (1992).** Peaches, plums and nectarines. California Univ. Publication 3331, USA.
- Maged, S., Mokhtar, H. and El-Sherif, H. (2019).** Effect of some Dormex breaking agents on flowering and fruiting of "Le-Conte" pear trees under Giza conditions. J. Hort. Sci. & Ornamental Plants, (3): 223-231.
- Mohamed, A.J. and Mohamed, H. (2017).** Studies on flowering, fruiting and residual effect of some breaking dormancy agents on two plum cultivars. DOI: 10.21608/EJAR 2017.146843 .95 (1).183-205.
- Mahrous, H.A. and El-Fakharani, E.M. (2006).** Effect of some dormancy breaking agents on productivity, fruit quality and powdery mildew severity of apricot. Acta Hortic, 701:659-664.
- Mansour, N.M.; Shahin B. A. and Attala, E.S. (1999).** Effect of endo-dormancy breaking agents on "Florida Prince" peach cv. J. Agric. Mansora Univ. 24(12): 7535-7545.
- Ramina, A., Tonutti, P., and McGlasson, W. B. (1995).** Ripening and postharvest physiology of fruits. In P. J. Davies (Ed.), Plant hormones: Physiology, biochemistry and molecular biology (2nd ed., pp. 509–528). Dordrecht: Kluwer Academic Publishers.
- Rusin, C., Sapelli, K.S., Schoroeder, R., Cabral, J.G. and Botelho, R.V. (2022).** Overcoming dormancy in "Laetitia" plum trees with the use of mineral oil, vegetable oil and copper sulphate. Acta Horticulturae, 1354: 34. <https://doi.org/10.17660/ActaHort.2022.1354.34>
- Sagredo, K.; Theron K. and Cook N. (2005).** Effect of mineral oil and hydrogen cyanamide concentration on dormancy breaking in "Golden Delicious" apple trees, 10.1080/02571862.2005.10634716
- Shakweer, N. H. (2004).** Studies on the rest period and breaking dormancy of vegetative and floral buds of "Canino" apricot. M.Sc., Thesis, Agric. Fac. Ain Shams Univ.
- Shahin, B.A., Bahloul S.E. and Mokhtar H. (1997).** Dormancy breaking of "Eldorado" plum trees with some chemicals. J. Agric. Sci. Mansora Univ., 22(11):3887-3894.
- Snedecor, G.W. and Cochran, W.G. (1995).** Statistical methods. 7th ed. Iowa State Univ. press, USA p 593.
- Westwood, M.N. (1993).** Temperate-zone pomology: physiology and culture. 3rd ed. Timber press Inc. Portland Oregon USA P 488.
- Williams, R.R. (1970).** Techniques used in fruit set experiments. Wilson D. Ed. Books. London pp 57-61.
- Zayan, M.A. Mikhael, G.B. and Okba, S.K. (2016).** Treatments for improving Tree growth, yield and fruit quality and for reducing double fruit and deep suture incidence in peach trees. Interna. J. Hortic. Sci., 22(3-4):7-19.

الملخص العربي

تأثير التذبذب في درجات الحرارة على نمو وإثمار ومحصول بعض أصناف البرقوق تحت ظروف محافظة القليوبية

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تم إجراء هذه الدراسة على 3 أصناف من البرقوق الياباني ؛ هوليوود بيبونير واسباني مطعومين على أصل البرقوق الماريانا. الأشجار كانت بعمر 6 سنوات منزرعة على مسافات 4×4 متر (260 شجرة بالفدان) تحت نظام الري بالغمر في محطة بحوث البساتين بالقناطر الخيرية، مصر. تم رش الأشجار أيام 23 يناير، الأول من فبراير، 15 فبراير خلال عامي 2023/2022 و 2024/2023 وذلك بتركيزات 0.5 ، 1.0 و 1.5 % دورمكس (سيناميد الهيدروجين) + 3 % زيت كابل (زيت صيفي) وقد صممت التجربة في قطاعات كاملة العشوائية (تجربة عاملية). أوضحت النتائج أن صنف الهوليوود كان مبكراً في التزهير (18-22 فبراير) والعقد (15-16 مارس) وجمع المحصول (1-18 مايو) مع أقصر فترة تزهير (23-36 يوم) ونمو للثمار (35-63 يوم). ثمار صنف الهوليوود كانت أعلى في نسب السكريات الكلية الذائبة (TSS) ونسبة السكريات الكلية / الحموضة (TSS/acid ratio) مع أقل نسبة حموضة، وأعطت أكبر عدد من الثمار على الشجرة مع صلابة عالية وعائد نقدي أعلى من الصنفين الآخرين خلال الموسم الأول من الدراسة. أعطى صنف بيبونير أكبر محصول وأعلى كفاءة للمحصول (كمية المحصول ÷ المساحة التي تشغلها الشجرة) كما كان تزهير صنف بيبونير متداخل مع فترة التزهير لكل من صنفي هوليوود والاسباني مما يساعد على ضمان التلقيح الخلطي بين الأصناف الثلاثة. كما أعطى عدد أكبر من الثمار على الشجرة وصلابة ووزن وحجم للثمار وقيمة نقدية للثمار، كما أعطى أعلى عائد نقدي للمحصول خلال الموسم الثاني للتجربة. تميز الصنف الاسباني بأنه أعطى أعلى نسبة لعقد الثمار مع وزن وحجم أكبر للثمار، هكذا نستطيع من خلال هذه الدراسة أن نوصي مزارعي البرقوق لتفضيل زراعة صنفي هوليوود وبيبونير مع رشهم عند توفر 74-109 ساعة برودة أقل من 7.2 °م أو 326-393 ساعة برودة أقل من 10.0 °م . يفضل الرش يوم 15 فبراير بـ 1.5 % دورميكس + 3 % زيت كابل 2 حسب التذبذب في درجات الحرارة وذلك للحصول على تزهير مبكر وتلقيح خلطي مناسب يسبب نسبة عقد أفضل ومحصول أعلى وبالتالي زيادة دخل المزارعين.