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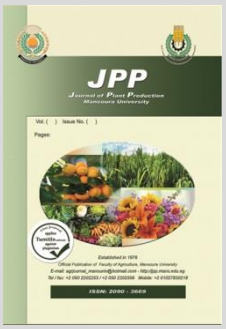
Response of "White Robin" Peach Trees Cv. (*Prunus persica* L.) to Cultivation Under Plastic Covering Conditions and Foliar Application by Hydrogen Cyanamide and Garlic Extract

Kotb, H. R. M.[1]; M. A. M. El-Abd[1] and A. Salama[2*]

[1]Deciduous Fruit Dep., Horticulture Research Institute- Agriculture Research Center, Egypt.

[2]Horticulture Dep., Faculty of Agriculture, Kafrelsheikh University, Egypt



ABSTRACT

A field experiment was carried out during 2018 and 2019 seasons on 4 years old 'White Robin' peach trees cv. (*Prunus persica* L.), to investigate the effect of cultivation peach trees under plastic covering conditions (PC) with combination of hydrogen cyanamide (HC at 0.5%) as a Dormex and garlic extract (GE at 1%) on floral and vegetative bud break time, vegetative growth parameters, fruit set, yield and fruit quality of this cultivar. Eight treatments, HC alone, GE alone, HC + GE, PC alone, PC + HC, PC + GE, PC + HC + GE and control were applied. The application of HC and GE under PC, resulted in earlier buds break and harvesting period by 10 and 20 days, respectively. Moreover, it shortened the period between both of flower and vegetative buds break and onset to end fruit harvesting by 10 days. It significantly increased shoot length, diameter and leaf area compared to control and other treatments. Furthermore, it improved fruit physical and chemical properties beside increasing the yield by 30%. All studied parameters gradually improved by other investigated treatments as follow: PC + HC, PC + GE, PC alone, HC and GE, HC alone then GE alone compared by control. Plastic covering might be useful for early peach cultivars for advancing fruit maturity and improving yield and fruit quality, that will be more suitable for exportation and profitable for growers under conditions of Egypt.

Keywords: White Robin peach, protected cultivation, Dormex, Garlic Oil, budbreak and fruit quality.
Abbreviations: HC (hydrogen cyanamide), PC (plastic covering), GE (garlic extract), PC (protected cultivation)

INTRODUCTION

The peach (*Prunus persica* L.) is one of the most important temperate fruits (Shulaev *et al*., 2008). Besides its bearing an edible juicy fruit and heavy crop load. It considers a rich source of carbohydrates, minerals and vitamins. Egypt is the 8th largest world producer of peaches. In 2017, Egypt produced 360,723 tonnes from the area of 24,707 ha (59297 feddans), exported 19,250 tonnes by 21.3 million US$(FAO, 2019).

To prolong the time of peach marketing, many new peach cultivars had been introduced, mainly from the U.S.A. by the Agriculture Development System (Mansour *et al*., 1982; Stino *et al*., 1982 and Shaltout, 1995). 'White Robin' is one of the most promising new cultivar due to early harvest and desirable fruit quality with acceptable yield. It has been recently introduced to Egypt. Peach growers always prefer early cultivars to obtain higher prices from both exportation and the local market (Ahmed *et al*., 2009). Unfortunately, they are have been facing by many production challenges during the beginning of peach growing season (January and February), such as weather conditions and insufficient heat unit that delay bud opening, prolong and scattered flowering period and non-uniform leafy buds opening, resulted in inhomogeneous of fruits development stages and harvesting date. Under these conditions, a great loss of crops has also occurred.

In last decades, many research studies have been done for using some chemical and natural substances to induce budbreak for the many of deciduous fruit trees (Ionescu, *et al.*, 2017). Only a few of them are effective in field treatments, such as cyanamides (Erez, 1979; Saure, 1985). Dormex™ is a synthetic compound containing hydrogen cyanamide (HC) as its active ingredient. It has been widely used to break bud dormancy (Bartolini *et al*., 1997). It penetrates the buds then initiates the processes leading to bud break (Foott, 1987). Moreover, it is rapidly metabolized by plants and aids in the synthesis of amino acids through catalase activity (Shulman *et al*., 1983; Seif El-Yazal *et al*., 2012). Besides, it induces early bud break, it can also help in more uniform of bud break and fruit maturity (Georg *et al*., 1988).

The U.S. Environmental Protection Agency (EPA) classified Dormex® at the highest toxicity category (Settimi *et al*., 2005). Therefore, the use of alternative products to hydrogen cyanamide is very important for the sustainable expansion of temperate-climate to fruit production. Additionally, synthetic compounds cause extensive pollution and are more costly. Thus, using natural products is becoming the main goal to avoid the toxicity of synthetic compounds and easily available (Dimitri and Oberholtzer, 2006). In this respect, garlic extract is used for advancing bud break where it is responsible for breaking buds dormancy in Grapevines.

* **Corresponding author.**
E-mail address: ask002047@yahoo.com
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Whatever, its effects varied by the concentration and the duration of exposure (Kubota *et al*., 1999). The active substances in garlic has revealed a high concentration of sulfur compounds 1-3% (Koch and Lawson, 1996). Important sulfur-containing compounds presented in garlic homogenate are allyl methyl thiosulfonate, 1-propenyl allylthiosulfonate and -L-glutamyl-S-alkyl-L-cysteine (Block,1985). Substances with the sulfur molecules are interrupting the dormancy-breaking of different species of deciduous plants and inducing a sharp increase in bud respiration rate (Hartmann, 2000).

Recently, protected cultivation (PC) a new system of cultivation has been used for peach production in China and more newly it introduced to Japan, Korea and Russia (Gao *et al*., 2010). Only 7% of protected cultivation area in China is cultivated by fruits and flowers although they are more profitable than vegetable production under protected conditions (Layne *et al*., 2013). It is practiced with early cultivars for advancing fruit ripening. Thus, fruit can be sold by higher price. Also, PC could overcome some weather challenges such as insufficient heat units for bud growing and wind during early spring. The first success of protected peach cultivation was noted in 1995 at Shandong Agriculture University (Gao, *et al*, 2004). The fruit inside PC ripen very early season (March) when the fruits grown outside are not yet available. As early fruit harvested as higher price grower get (Layne *et al.*, 2013). Early-season cultivars have been used along with low-chilling requirement cultivars, because these allow the earliest pickings. Under protected cultivation fruits can be harvested about 30-45 days earlier than in traditional orchards (Gao *et al*., 2004). Fruits yield was higher in the trees under greenhouse compared with similar trees in the open field, but the costs were more than three times higher for protected culture. Due to higher yields and higher prices for early-season fruit, the protected culture system was more profitable than the standard system (Layne, 2009 and Layne *et al*., 2013). Other advantage for using protected cultivation is to reduce pesticide residues by control of insects.

Delayed foliation is the most important problem which faces 'White Robin', early peach cultivar in Egypt, resulted in low fruit set and yield. This work aimed to investigate the effects of cultivation of peach trees under plastic covering conditions with combination of foliar application of cyanamide hydrogen as Dormex and / or garlic oil on floral and vegetative bud break time, vegetative growth parameters, fruit set, yield and fruit quality of "White Robin" peach cultivar.

MATERIALS AND METHODS

The present investigation was carried out during two successive growing seasons 2018 and 2019 on new introduced peach cultivar "White Robin" (*Prunus persica* L.), budded on Nemaguard peach rootstock, grown in a private orchard at Sadat city region, El-Menoufia governorate, Egypt. The orchard trees were spaced at 4x5 meters apart and were maintained under the standard cultural practices commonly adopted for this area. The soil was sandy well drained, and the trees were under dripping irrigation. The experiment was performed on 4-years-old trees, trained to open-vase shape. Twenty-four trees were selected as uniform as possible in growth, productivity and appearance for this study, three replicates for each treatment, one tree for each replicate. Trees were sprayed to the runoff using a hand sprayer once, on (1st and 5th December) after winter pruning at buds dormant stage for 2018 and 2019, respectively. The treatments were as following:

1. Control (spraying with water only).
2. Hydrogen Cyanamide (H_2CN_2) at 0.5%
3. Garlic Extract (GE) at 1%
4. H_2CN_2 at 0.5%+ GE at 1%
5. Plastic covering only
6. Plastic covering + H_2CN_2 at 0.5%
7. Plastic covering + GE at 1%
8. Plastic covering + H_2CN_2 at 0.5% + GE at 1%

After spraying, selected trees were covered by white plastic (3.5 m in hight) at 5st and 10th December for the first and second seasons, respectively. This experiment consisted of eight treatments arranged in a randomized complete blocks design with three replicates for each treatment and one tree for each replicate. The non-ionic surfactant Tween 20 at 0.05% (v/v) was added to all treatments to reduce the surface tension and increase the contact angle of sprayed droplets. Trees were sprayed to the runoff using a hand sprayer.

Measurements:

In winter, ten shoots were randomly tagged for all directions of each tree to record the date of onset flowering, full bloom, onset of fruit set, vegetative bud break and onset of fruit harvest.

Vegetative growth parameters:

In the spring of each season, 20 developing shoots of spring cycle at all directions of each tree were marked at constant height. In July, the average of shoot length, diameter (cm) and leaf area (cm^2) were determined.

Leaf minerals content

At May, 20 leaves/tree were collected representing the four cardinal directions (James *et al*., 1989). Total nitrogen and phosphorus were determined colorimetrically according to the methods of Murphy and Riley (1962) and (Evenhuis, 1976), respectively. Potassium was determined against a standard, using an air propane flame photometer (Chapman and Pratt, 1961). The concentration of nitrogen, phosphorus, and potassium was expressed as a percentage.

Fruit set percentage

Four branches from each tree were chosen and marked for recording the data on the total number of flowers and the total number of developed fruitlets after 2 weeks of petal fall. The fruit set percentages were calculated according to the following equation:

Fruit set % = Total number of fruitlets / Total number of flowers x100

Yield

At harvest period, the fruits per each tree were counted and weighted, then the total yield / tree (kg) was calculated. Average fruit weight was determined and yield per feddan by multiplying yield per the tree in the number of trees per feddan (tons).

Fruit Quality:

At harvest, sample of 20 fruits for each replicate was randomly collected, then transported to the laboratory

at the same day to determine physical and chemical fruit characteristics.

Fruit Physical characteristics:

Fruit dimensions as length and diameter (cm) were measured by using hand caliper. Fruits firmness was expressed as (lb/ $Inch^2$) according to (Magness and Taylor, 1982).

Fruit chemical characteristics:

Another sample of 10 fruits of each replicates in both seasons randomly was selected to determine the following chemical characteristics**:** soluble solids contents (SSC) was measured by hand refractometer, titratable acidity % (TA) as malic acid was determined by titration using 0.1 N of NaOH according to (A.O.A.C., 2005). Anthocyanin was extracted from 1.0 g fruit fresh peel from color cheek, was extracted by using 25 ml of the extraction solution 85% (ethyl alcohol 95%) + 15% (HCL 1.5N) and anthocyanin content as mg/100g fresh weight was measured by photoelectric colorimeter at 530 nm, according to the method of (Özgen *et al*.,2009).

Statistical design and analysis

The obtained data were statistically analyzed as a RCBD by analysis of variance (ANOVA) according to Snedecor and Cochran (1989) using Statistical Analysis System (CoStat) program. Comparisons among means were made via using the Newly Least Significant Differences (NLSD) test at 0.05 level of probability as mentioned by Waller and Duncan, (1969)

RESULTS AND DISCUSSION

Onset flowering, full bloom, onset of fruit set, vegetative buds break and onset fruits harvest:

Data on the effect of different treatments on onset of flowering, full bloom, onset of fruit set, break of vegetative bud and onset of fruit harvesting of 'White Robin' peach during 2018 and 2019 seasons have been presented in Tables 1 and 2. The application of hydrogen cyanamide (HC) and plastic covering (PC) revealed earlier in all previous characteristics in both seasons. The combination of PC and application of HC and GE treatment gave the highest effect where they resulted in 10 days earlier for the onset of flowering and 20 days for the full bloom, onset of fruit set, vegetative bud break and onset of fruit harvesting, than the control and GE alone for the both of seasons. The application of HC alone or combined with PC and/or GE decreased the duration of flowering (from onset to full bloom) and fruit harvesting from 5 to 10 days and 10 to 20 days for the 2018 and 2019, respectively. Moreover, the treatments of (PC + HC and PC + HC and GE) shortened the period between onset of flowering and vegetative bud break and from the beginning to end of harvesting by 10 days during the both seasons Figure 1. Short period between flowering to vegetative bud break may help in increasing of fruit size. Also, all treatments contain plastic covering (PC) hastened vegetative bud break compare to those of the other treatments in both seasons. Many previous studies found that the application of hydrogen cyanamide before flowering by four weeks is very effective for inducing early bud break not only but also short period of flowering (Georg *et al*., 1988; George *et al*., 1992; Seif El-Yazal and Rady, 2012). The flowering in short period can help in more uniform of fruit maturity and availability for harvesting. The best results for the onset of fruit harvesting obtained by combining plastic covering + 0.5% hydrogen cyanamide and 1% garlic extract. They induced earlier in harvesting about two weeks than the control. Similar results obtained by El Abd, (2011), on 'Florida Prince' peach cultivar under protected cultivation. Who found that the fruit harvesting started earlier about 30 to 45 days than the control treatment. Also, Ghrab and Mimoun (2014) found that the application of hydrogen cyanamide on pistachio lead to advance in flowering by 11 days than the untreated trees. Vegetative buds requirements of heat units are higher than flower buds which leads to earlier flower bud break than vegetative bud. The cultivation under protected cultivation may provide more suitable conditions for vegetative buds break.

Table 1. Effect of different treatments on dates of onset flowering, full bloom, onset of fruit set, vegetative buds break, onset fruit harvest and harvest period (onset to end) of "White Robin" peach cultivar during 2018

Treatments	onset flowering	Full bloom	Onset fruit set	Vegetative bud break	Onset fruit harvest	Harvest period (onset to end)
Control	5 Jan	25 Jan	30Jan	5 Feb	30 Mar	45
HC 0.5%	30 Dec	15 Jan	20 Jan	25 Jan	20 Mar	30
GE at 1 %	5 Jan	25 Jan	30 Jan	5 Feb	30 Mar	35
HC at 0.5% + GE at 1 %	30 Dec	15 Jan	20 Jan	25 Jan	25 Mar	30
PC	30 Dec	15 Jan	20 Jan	20 Jan	20 Mar	30
PC + HC 0.5%	25 Dec	5 Jan	10 Jan	15 Jan	15 Mar	25
PC + GE 1 %	25 Dec	10 Jan	15 Jan	20 Jan	20 Mar	30
PC + HC 0.5%+GE 1%	25 Dec	5 Jan	10 Jan	15 Jan	15 Mar	25

Table 2. Effect of different treatments on dates of onset flowering, full bloom, onset of fruit set, vegetative buds break, onset fruit harvest and harvest period (onset to end) of "White Robin" peach cultivar during 2019

Treatments	onset flowering	Full bloom	Onset fruit set	Vegetative bud break	Onset fruit harvest	Harvest period (onset to end)
Control	10 Jan	30 Jan	5 Feb	10 Feb	5 April	35
HC 0.5%	5 Jan	20 Jan	25 Jan	30 Jan	25 Mar	30
GE at 1 %	10 Jan	30 Jan	5 Feb	10 Feb	5 April	35
HC at 0.5% + GE at 1 %	5 Jan	20 Jan	25 Jan	30 Jan	30 Mar	30
Plastic Covering (PC)	5 Jan	20 Jan	20 Jan	30 Jan	25 Mar	25
PC + HC 0.5%	30 Dec	10 Jan	15 Jan	20 Jan	20 Mar	25
PC + GE 1 %	30 Dec	15 Jan	20 Jan	25 Jan	25 Mar	25
PC + HC 0.5%+GE 1%	30 Dec	10 Jan	15 Jan	20 Jan	20 Mar	25

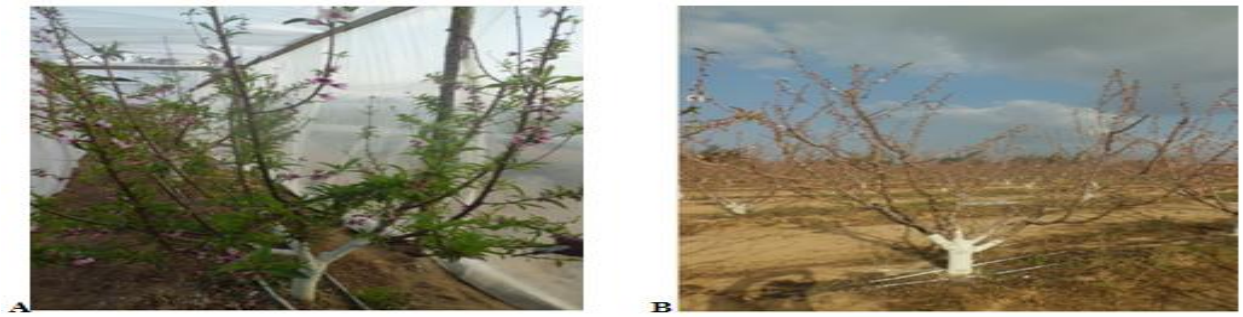

Figure 1. Show the effect of plastic covering (PC) on buds break (A) peach trees covered by plastic (on the left) and (B) peach trees in open field (On the right).

Vegetative growth

The effects of different treatments on the shoot length, diameter and leaf area is shown in Table 3. Results proved that, all treatments significantly increased shoot length, diameter and leaf area compared to those of the untreated control in both seasons. Moreover, treatment HC combined with PC and GE gave the highest value for 'White Robin' peach cultivar in both seasons. The positive effects of agricultural practice such as plastic covering and application of hydrogen cyanamide alone and or garlic extract may due to early buds breaking with higher temperature under plastic covering (about 8-10 °C higher than open field). Breaking dormancy agents may increase soluble protein (Jana and Bikash, 2014), change the protein structure and increase starch and C:N ratio content of the cells (Rahman *et al*., 2002; Pandey *et al*., 2013). Similar results were obtained by Gaaliche *et al*., (2017) on fig trees treated by 1% and 1.5% hydrogen cyanamide. They found that 1.5% hydrogen cyanamide significantly increased vegetative growth and starch content of shoots. On the other hand, Ghrab and Bin Mimoun (2014) found that no significant effects of hydrogen cyanamide as a Dormex on vegetative growth of pistachio trees. However, Rahemi and Asghari (2004) found a positive effect of 4% Dormex application on vegetative growth of pistachio.

Table 3. Effect of some chemical and cultural treatments on shoot length, diameter and leaf area of "White Robin" peach cultivar during 2018 and 2019

Treatments	Shoot length (cm)		Shoot diameter (cm)		Leaf area (cm^3)	
	2018	2019	2018	2019	2018	2019
Control	58.48 g	63.23 g	0.51 h	0.54 h	26.54 d	28.39 g
HC 0.5%	74.92 e	77.12 e	0.61 f	0.64 f	31.07 c	31.89 e
GE at 1 %	62.49 f	65.30 f	0.54 g	0.57 g	27.31 d	30.70 f
HC at 0.5% + GE at 1 %	76.17 e	79.12 d	0.63 e	0.67 e	32.00 bc	32.78 d
PC	77.73 d	79.46 d	0.66 d	0.71 d	32.39 b	35.61 c
PC + HC 0.5%	88.55 b	93.42 b	0.78 b	0.82 b	35.07 a	38.36 a
PC + GE 1 %	79.51 c	90.47 c	0.68 c	0.74 c	32.27 bc	36.71 b
PC + HC 0.5%+GE 1%	93.94 a	95.84 a	0.81 a	0.87a	35.77 a	38.77 a
L.S.D at 0.5%	1.54	1.383	0.0146	0.0127	1.186	0.824

Values within each column followed by the same letter (s) are not significantly different at 5% level.

Fruit set and yield

Data on the effect of the different treatments on fruit set, yield per tree and yield per feddan (hectare = 2.4 feddan), displayed in Table 4. Treatment 8 (application of HC + GE + PC) revealed the highest fruit set percentage and fruit yield. It resulted in about 1.5-fold compared by untreated control treatment for fruit set for the both of seasons. It was found from data in Table 4 that application a combination of HC, GE and PC resulted in 2.25 and 2.16 tons more than control treatments for the 2018 and 2019 seasons respectively, which represent about 30% increasing in fruit yield. The increase in fruit set and yield may due to early leafy buds break in treatments that are combined with PC. These results are in agreement with pervious research by Mohamed and Sherif (2015) on 'Florida Prince' peach cultivar. They found that peach trees treated by hydrogen cyanamide (Dormex) recorded the highest fruit set % and fruit yield. Ghrab and Bin Mimoun (2014) reported similar results on Pistachio. They found that the application 4% Dormex significantly increased the fruit yield. Similar results were obtained on apples (Jackson and Bepete, 1995).

Table 4. Effect of some chemical and cultural treatments on fruit set, yield/tree and yield/feddan of "White Robin" peach cultivars during 2018 and 2019

Treatments	Fruit set (%)		Yield/tree (kg)		Yield/feddan (ton)	
	2018	2019	2018	2019	2018	2019
Control	22.79 e	24.73 e	28.53 e	30.19 e	5.99 e	6.34 e
HC 0.5%	27.54 d	29.35 c	32.46 c	34.21 c	6.82 c	7.18 c
GE at 1 %	24.35 e	26.99 d	30.89 d	32.69 d	6.48 d	6.86 d
HC at 0.5% + GE at 1 %	29.22 c	30.49 c	33.79 a	36.39 b	7.10 b	7.64 b
PC	30.85 b	33.09 b	32.85 c	35.00 c	6.87 c	7.35 c
PC + HC 0.5%	34.20 a	36.20 a	37.09 a	38.65 a	8.17 a	8.26 a
PC + GE 1 %	31.11b	32.94 b	34.60 a	37.35 b	7.26 b	7.84 b
PC + HC 0.5%+GE 1%	34.98 a	36.63 a	37.36 a	39.26 a	8.24 a	8.40 a
L.S.D at 0.5%	0.227	1.319	0.805	1.109	0.205	0.246

Values within each column followed by the same letter (s) are not significantly different at 5% level.

Fruit physical properties

All treatments, compared with control, significantly increased fruit length, diameter, weight, flesh weight and stone weight (Table 5). The application of HC + GE + PC treatment led to the highest value of all previous characteristics, followed by HC + PC, GE + PC, PC alone, HC + GE, HC alone, GE alone then untreated control. On the other hand, all treatments under plastic covering (PC), revealed decreasing in fruit firmness (Table 5). The application of GE alone resulted in the highest fruit firmness followed by HC and GE treatment. No significant differences among treatments under PC have been noted. The same trend was found for the both of seasons. Mohamed and Sherif (2015) reported similar results on physical properties of 'Florida Prince' peach treated by Dormex 0.5%, where, treated trees revealed the highest fruit weight hight, stone weight and flesh thickness. Moreover, treated trees revealed the lowest fruit firmness compared with untreated control. Also, the present results are in agreement with the results obtained by Chauhan *et al.*, (2018) on the 'Starking Delicious' apple cultivar. They found that the foliar application of Dormex at 1% 4 weeks prior expected day for bloom led to the highest fruit weight, volume and size in terms of hight and diameter. Previous studies by Gaaliche *et al*., (2017) on fig trees, Rahemi and Asghari (2004) on pistachio, Gabr *et al*., (2011) and Hegazi, (2012) on 'Canino' apricot revealed similar results. In respect to protected cultivation, layne *et al*., (2013) reported that the peach trees are grown under protected cultivation produced larger fruit than trees grown outside in the same location. Similar results were noticed with nectarine (Jiang, *et al*., 2004).

Table 5. Effect of some chemical and cultural treatments on fruit physical characteristics of "White Robin" peach cultivar during 2018 and 2019

Treatments	Fruit hight (cm)	Fruit diameter (cm)	Fruit weight (g)	Flesh Weight (g)	stone Weight (g)	Firmness (lb/ Inch2)
			2018			
Control	4.47 e	5.07 f	87.68 f	83.67 f	4.01 g	9.03 b
HC 0.5%	5.00 d	5.53 d	96.51 d	92.28 d	4.23 ef	9.08 b
GE at 1 %	4.67 e	5.33 e	89.62 e	85.50 e	4.13 f	9.72 a
HC at 0.5% + GE at 1 %	5.17 cd	5.73 c	97.57 d	93.31 d	4.27 e	9.56 a
PC	5.17cd	5.77 bc	100.75 c	96.38 c	4.37 d	8.48 c
PC + HC 0.5%	5.43 ab	6.03 a	107.63 a	102.86 a	4.77 b	8.43 c
PC + GE 1 %	5.27 bc	5.87 ab	104.22 b	99.61 b	4.61 c	8.34 c
PC + HC 0.5%+GE 1%	5.63 a	6.10 a	107.93 a	102.95 a	4.98 a	8.30 c
L.S.D at 0.5%	0.226	0.110	1.122	1.123	0.100	0.284
			2019			
Control	4.63 g	5.33 e	89.39 f	84.97 f	4.41 e	8.75 c
HC 0.5%	5.07 e	5.73 c	98.51 d	94.28 d	4.23 de	9.70 a
GE at 1 %	4.83 f	5.47 d	90.98 e	86.81 e	4.17 e	8.89 c
HC at 0.5% + GE at 1 %	5.23 d	5.77 c	100.33 c	95.97 c	4.36 cde	9.10 b
PC	5.17d	5.83 c	104.90 b	100.31 b	4.59 cd	8.44 d
PC + HC 0.5%	5.63 b	6.33 a	109.76 a	104.87 a	4.89 b	8.23 e
PC + GE 1 %	5.37 c	6.07 b	108.47 a	103.77 a	4.70 bc	8.39 de
PC + HC 0.5%+GE 1%	5.83 a	6.37 a	109.60 a	104.42 a	5.18 a	8.20 e
L.S.D at 0.5%	0.090	0.097	1.430	1.513	0.270	0.188

Values within each column followed by the same letter (s) are not significantly different at 5% level.

Fruit chemical properties

The effects of various treatments on fruit chemical characteristics of 'White Robin' are shown in Table 6. Soluble solid content (SSC) was recorded the highest values (12.80 and 12.87 %) in trees treated by HC + GE + PC during the both seasons compared with control treatment which gave the lowest SSC percentages (11.20 and 11.27 %). In the untreated trees, the fruit acidity % recorded (0.39 and 0.41 %) which, was significantly higher than all other treatments. The trees were treated by HC alone without PC gave the highest anthocyanin concentration in the fruit during the both seasons, followed by HC plus GE. No significant differences were noticed among treatments without PC. On the other hand, the lowest anthocyanin concentration was recorded in the HC + GE + PC treatment although no significant differences were found with all treatments under PC treatments. These results are in agreements with those obtained by Mohamed and Sherif (2015) on 'Florida Prince' peach cultivar. They found that the treated trees by Dormex gave the highest SSC values and lowest acidity%. Jiang *et al*., (2004) found that the fruit produced under plastic covering has higher sugar content than those grown in open field. Similar results were found in 'Canino' apricot (Gabr, *et al*., 2011 and Hegazi, 2012) and 'Le Conte' pear (Ismail *et al*., 2006). Regarding anthocyanin, the concentration was lower in fruits under PC. It may be due to high crop load of fruit under plastic covering where the trees gave more than 30% fruit yield. Moreover, light level and quality outside are rather different than under plastic covering which are playing main roles in anthocyanin biosynthesis (Zhang *et al*., 2014). Gao *et al*., (2010) noted that under greenhouse environment, the light level reduced from 30 to 40%.

Table 6. Effect of some chemical and cultural treatments on fruit chemical characteristics of "White Robin" peach cultivar during 2018 and 2019 seasons

Treatments	SSC (%)		Acidity (%)		Anthocyanin (mg/100g)	
	2018	2019	2018	2019	2018	2019
Control	11.20 e	11.27 d	0.39 a	0.41 a	17.91 bc	18.47 a
HC 0.5%	11.60 de	11.80 bcd	0.36 c	0.39 a	19.34 a	19.30 a
GE at 1 %	11.47 de	11.73 cd	0.37 b	0.40 a	18.43 ab	18.85 a
HC at 0.5% + GE at 1 %	11.80 cd	12.00 bcd	0.32 d	0.36 b	18.80 ab	19.12 a
PC	12.00 cd	12.47 abc	0.32 d	0.33 c	17.23 c	16.29 b
PC + HC 0.5%	12.67 ab	12.87 a	0.27 ef	0.29 d	15.79 d	15.00 b
PC + GE 1 %	12.20 bc	12.60 ab	0.29 e	0.31 c	15.55 d	16.06 b
PC + HC 0.5%+GE 1%	12.80 a	12.87 a	0.26 f	0.27 d	15.39 d	15.54 b
L.S.D at 0.5%	0.523	0.766	0.0137	0.021	0.988	1.228

Values within each column followed by the same letter (s) are not significantly different at 5% level.

Leaf minerals contents:

Effects of various treatments on leaves N, P and K contents are presented on Table 7. The spraying a combination of HC + GE + PC gave the highest significant increase of N, P and K concentrations of leaves of "White Robin" peach trees compared with all other treatments during the two seasons. Moreover, all other treatments also significantly increased N, P and K compared with the control except HC treatment which did not have significantly increase. Generally, control treatment recorded the lowest minerals content for the two seasons. Dormex application increased stored and uptake of N in apple trees. It is found also that the soluble and total N increased by Dormex and or mineral oils application (Seif El-Yazal and Rady, 2012). In previous research work found that foliar application of Dormex lead to increase in bud temperature compared with untreated control. Temperature either inside the plant or in microclimate is playing a main role in both of element uptake and availability.

Table 7. Effect of some chemical and cultural treatments on leaf of N, P and K contents of "White Robin" peach cultivar during 2018 and 2019 seasons

Treatments	Leaf N (%)		Leaf P (%)		Leaf K (%)	
	2018	2019	2018	2019	2018	2019
Control	2.22 f	2.28 f	0.21 d	0.23 d	1.29 f	1.33 d
HC 0.5%	2.22 f	2.31 f	0.21 d	0.23 d	1.32 e	1.35 d
GE at 1 %	2.35 e	2.40 e	0.23 c	0.24 c	1.36 d	1.38 c
HC 0.5% + GE 1 %	2.38 d	2.42 de	0.23 c	0.25 c	1.38 c	1.39 c
PC	2.39 d	3.45 cd	0.23 c	0.27 ab	1.41b	1.41 b
PC + HC 0.5%	2.41 c	2.46 c	0.22 c	0.26 b	1.42 b	1.42 b
PC + GE 1 %	2.49 b	2.52 b	0.24 b	0.27 ab	1.39 c	1.42 b
PC + HC 0.5%+GE 1%	2.53 a	2.62 a	0.26 a	0.28 a	1.44 a	1.46 a
L.S.D at 0.5%	0.016	0.028	0.0088	0.012	0.0199	0.017

Values within each column followed by the same letter (s) are not significantly different at 5% level.

The economic value of using plastic covering and different treatments

Data in table 8, shows the economic value of using plastic covering and/or other treatments. The treatment 8 (plastic covering and HC and GE application) gave the highest total yield, total profit and net profit. All treatments led to higher profit than control. The plastic price and covering treatment are highly cost by 15,000 EGP /fed, but the profit is also very high. The high profit for covering treatments due to high and early yield production. The early production is sold by higher price (12 EGP), but at the end of the season the peach price is very low (5 EGP). The net profit of plastic covering is more than two fold compared with control treatment under this study.

Table 8. The economic evaluation of using plastic covering and/or different foliar applications on 'White Robin' peach cultivar

Treatments	Costs/Fed				Total[5] Yield (ton/ fed)	Price /kg[6] fruits (EGP)	Total[7] Profit /fed (EGP)	Net[8] Profit /fed (EGP)
	Foliar[1] application	Plastic[2] price	Labors[3]	Total[4] costs				
Control	-	-	-	-	6.16	5	30800	30800
HC 0.5%	250	-	100	350	7.00	7	49000	48650
GE at 1 %	400	-	100	500	6.67	6	40020	39520
HC at 0.5% + GE at 1 %	650	-	100	750	7.37	7	51590	51090
PC	-	12500	2500	15000	7.11	9	63990	48990
PC + HC 0.5%	250	12500	2600	15350	8.22	12	98640	83290
PC + GE 1 %	400	12500	2600	15500	7.55	9	67950	52450
PC + HC 0.5%+GE 1%	650	12500	2600	15750	8.32	12	99840	84090

[1)]The price of used chemicals (HC price is 125 EGP for one litre and the fedden needs two litres, GE price is 100 EGP and the fedden needs 4 litres.

[2)]The average price for one kg is 25 EGP and the fedden needs 500 kg of plastic.

[3)]It depends on the no. of workers and daily payment in this region.

[4)]Sum of 1&2&3.

[5)]Results of this work in table 4 (It is calculated of average of the two seasons).

[6)]It depends on the farm gate price (the price is average of the two seasons).

[7)]It is calculated of multiplication of 5 and 6.

[8)]It is calculated of subtraction 4 of 7.

Egyptian pound (EGP) and U$= 15.78 EGP, Fed = 0.4 Hectre

CONCLUSION

From the present study it can be concluded that the combination of foliar application by hydrogen cyanamide (HC 0.5%) and garlic extract (GE 1%) under plastic houses conditions are the best treatment in respect of early flower and vegetative buds break, early harvest, yield, fruit size, weight and SSC. Moreover, the treatments of (PC + HC and PC + HC and GE) shortened the period between onset of flowering and vegetative buds break and from the beginning to end of harvesting by 10 days that provides better chance for peach exportation and decrease the harvesting period and costs. Generally, all studied characters are better under plastic houses condition compared with open field. In the future, more research works are needed for studying water and nutrient requirements for peach trees under protected cultivation.

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استجابة أشجار الخوخ وايت روبن للزراعة تحت ظروف التغطية بالبلاستيك والرش بسينامید الهيدروجين ومستخلص الثوم

حاتم قطب[1] ، مصطفى العبد[1] وعبدالمعطي سلامة [2]

[1] باحث بقسم بحوث الفاكهة المتساقطة معهد بحوث البساتين مركز البحوث الزراعية

[2]قسم البساتين كلية الزراعة جامعة كفر الشيخ

أجريت هذه التجربة على خوخ وايت روبن خلال موسمي 2018-2019 لدراسة تأثير زراعة الخوخ وايت روبن تحت ظروف التغطية بالبلاستيك مع توليفات الرش بسينامید الهيدروجين ومستخلص الثوم على وقت تفتح البراعم الخضرية والزهرية والنمو الخضري ونسبة العقد ومحصول وجودة الثمار. أجريت التجربة في ثماني معاملات هي الرش بسينامید الهيدروجين منفردا (الدروميكس)؛ الرش بمستخلص زيت الثوم منفردا؛ الرش بسينامید الهيدروجين ومستخلص الثوم؛ التغطية بالبلاستيك منفردا؛ التغطية بالبلاستيك مع الرش بسينامید الهيدروجين؛ التغطية بالبلاستيك مع مستخلص الثوم؛ التغطية بالبلاستيك مع الرش بسينامید الهيدروجين ومستخلص الثوم؛ الكنترول. أدت التغطية بالبلاستيك مع الرش بسينامید الهيدروجن ومستخلص الثوم الى التبكير في موعد تفتح البراعم وجمع المحصول من 10 الى 20 يوما على الترتيب. أيضا أدت الى تقصير الفترة بين تفتح البراعم الزهرية والخضرية وكذلك من العقد الثمار الى الحصاد بحوالي 10 أيام. اضافة أن هذه المعاملة أدت لزيادة مؤكدة احصائيا في كل من طول وقطر الأفرع الخضرية والمساحة الورقية مقارنتا بالكنترول والمعاملات الأخرى. قد تحسنت الصفات الطبيعية والكيماوية للثمار وكذلك نسبة العقد والمحصول (حوالي 30%). جميع المعاملات أدت لنتائج ايجابية أفضل من الكنترول. التغطية بالبلاستيك سوف تكون مفيدة لزراعات الخوخ خصوصا الأصناف المبكرة وذلك لتبكير المحصول وزيادة المحصول مما يزيد من فرصة التصدير وزيادة العائد الاقتصادي للمزارع.