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STUDY ON THE EFFECT OF SPERMINE AND PUTRESCINE ON FREE POLYAMINES AND TSS OF APRICOT FRUITS (VAR: SHAHROODI 48)

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ABSTRACT

This study was done on Apricot trees (*Prunus armeniace* var SHAHROODI 48) in Kamal Abad garden in Alborz province. Three concentrations of Put and Spm (5, 10, 15 mM /Lit) was applied on trees in 5 different physiological times (Bud stage, 5 days after Bud stage, Full bloom, 5 days after Full bloom, 10 days after Full bloom). The content of free polyamines (Put, Spm, and Spd) was evaluated. The highest content of Put was observed in Put 15 mM /Lit, Spm in Spm15 mM /Lit, Spd in Spm 15 mM /Lit. The highest content of TSS was observed in Spm 15 mM/Lit.

Keywords: apricot, polyamines, spermidine, TSS, bud stage, full bloom.

INTRODUCTION

Apricot (*Prunus armeniaca* L.) is classified under the Prunus species of Prunodae, sub-family of the Rosaceae and family of the Rosales group. Apricot trees can grow over the five continents of the world and production level exceeds 3 million tons (FAO, 2010). Turkey, Iran, Uzbekistan, Italy and Argentina can be regarded as important apricot producer countries. While some of the countries such as Hungary, Morocco, Iran and Tunisia are important fresh apricot exporters, the others, such as Australia and Turkey, are major and famous dried apricot producers and exporters. Dried apricots which are in extensive demand in several parts of the world in USA, UK, Germany, Australia, etc., occupy an important place in the world trade (A.Jannatizadeh *et al*., 2008). Iran obtain second rate in world production with about 40000 tones and 50000 hectares after Turkey. As known, the fruit of apricot is not only consumed fresh but also used to produce dried apricot, frozen apricot, jam, jelly, marmalade, pulp, juice, nectar, extrusion products, etc.

Polyamines are ubiquitous, aliphatic polycation class of biogenic amines with essential function in living organisms. The most common plant polyamines are the diamine Putrescine and the higher polyamines spermidine and spermine. Spermine and spermidine were early examples of trimethylenediamine derivatives among natural products. Polyamines have been implicated in myriad of biological processes including cell proliferation, cell division and differentiation, apoptosis, homeostasis, gene expression, protein and DNA synthesis. In plants, Putrescine is formed from either argentine via an intermediate agmatine, a reaction catalyze by arginine decarboxylase, or from ornitine by ornitine decarboxylase. Spermidine is synthesize from Putrescine and the aminopropyl group donated by decarboxyated S-adenosylmethionine (SMA), which is a product of SMA decarboxylation (Figure-1) (Autar K.Mattoo *et al*., 2008).

Putrescine is known to improve plant growth and development due its effects on cell division and differentiation. Such findings were confirmed in bean plants by Altman *et al*., in 1982. Moreover, Putrescine (as one of the polyamine group) has a regulatory role in promoting productivity of many plants such as sweet pepper (Talaat., 2003), tomato (Cohen *et al*., 1982) and pea plants by Gharib and Hanafy, 2005 (El-Tohamy *et al*., 2008).

MATERIAL AND METHODS

This experiment was done in Apricot collection in Kamal Abad Garden which located in Kamal Abad city, Karaj, Alborz province. Traditional variety (SHAHRODI 48) was selected for this study. This Variety is one of the early seasons of apricot trees. After preparing 5, 10 and 15 mM/Lit of Spermine and Putrescine, they are painted on buds in two different times, bud stage and 5 days after bud stage. Because of the sensitivity of blooms, we have to spray solutions on blooms in three different times, Full Bloom, 5days after full bloom and 10 days after full bloom. Sampling was done in three stages; small fruit stage, peat hardening stage and full fruit set.

Polyamines were evaluated with HPLC and with Torrigiani method. In the laboratory TSS was valued with Refrectrometer.

RESULT AND DISCUSSIONS

The result of analysis of variance Table-1, shown that the content of free polyamines were affected with Spm, and Put. This content has a significant effect on the level of 1 %. According to the table using Polyamines had no significant effect on the TSS (Table-1).

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Table-1. The effect of polyamines treatment on free polyamines and content of TSS of fruit of Apricot Var. SHAHROODI 48.

Source	FD	TSS	Spd	Put	Spm
Stage	4	171.02**	42406.33**	65758.51**	30020.89**
Time	3	733.29**	86952.96**	78449.68**	28307.83**
Treatment	9	6.20ns	6141.36**	8120.60**	14094.99**
S*T	12	31.37**	12540.88**	12075.96**	5601.23**
S*Tr	36	3.46**	638.80**	1346.11**	518.73**
T*Tr	27	21.40**	4494.12**	2989.27**	3415.30**

**,*and ns: signification on the level of 1%, 5% and non significant

The effects of treatment on free Spm, Spd and Put

According to Figure-1 the highest content of Spm and Put was observed in Put1 5. The lower content of Spm and Put obtained in control samples. The highest content of free Spd obtained in Spm 15 and the lowest content of it obtained in Put 5 and control samples.

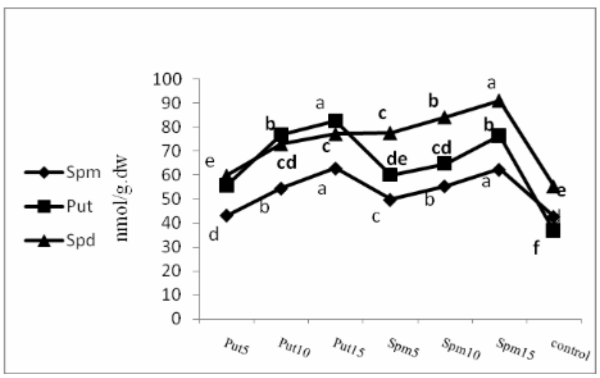

Figure-1. The effect of treatment on free Spm, Put, Spd.

The effects of time on free Spm, Put, and Spd

As it shows in Figure-2, the content of free polyamines was affected by time. The highest content of Spm and Spd was obtained in time 3. The highest content of Put was obtained in time 1. The lowest content of these polyamines were observed in time 2.

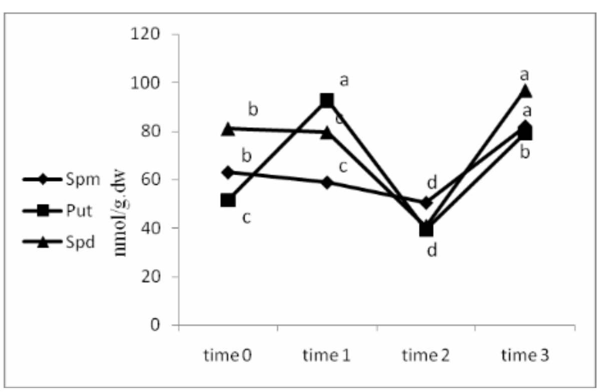

Figure-2. The effect of time on free Spm, Put, Spd.

The effects of time on free Spm, Put, Spd and TSS

According to Figure-3, the content of free poly amines was affected by Spm and Put. The highest content was observed in BS and the lowest was obtained in FB10. But the effect of these polyamines on the percentage of TSS hadn't significant effect between BS5 and FB5. So in BS it has the highest percentage and in FB10 had the lowest percentage.

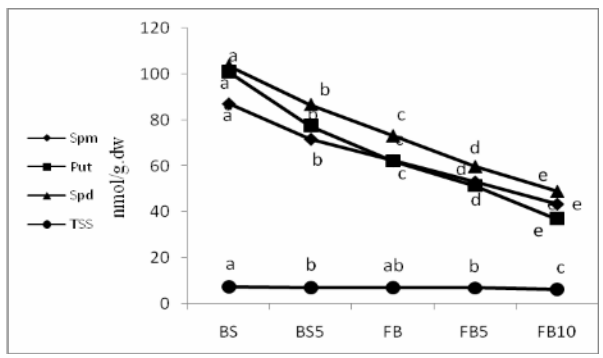

Figure-3. The effect of stage on free Spm, Put, Spd, TSS.

The effects of time and stage interactions on free Spm

According to Figure-4, the highest content of Spm was observed in BS and time 3. The lowest content of Spm was obtained in FB10 and time 1.

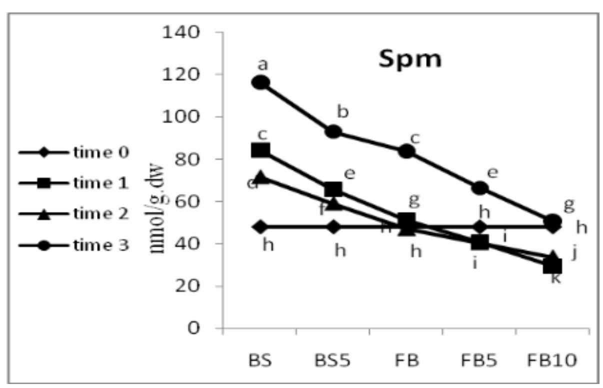

Figure-4. The effects of time and stage interactions on free Spm.

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The effects of time and stage interactions on free Put

According to Figure-5, the highest content of Put was observed in BS and time 3. The lowest content of Put was obtained in FB10 and time 2.

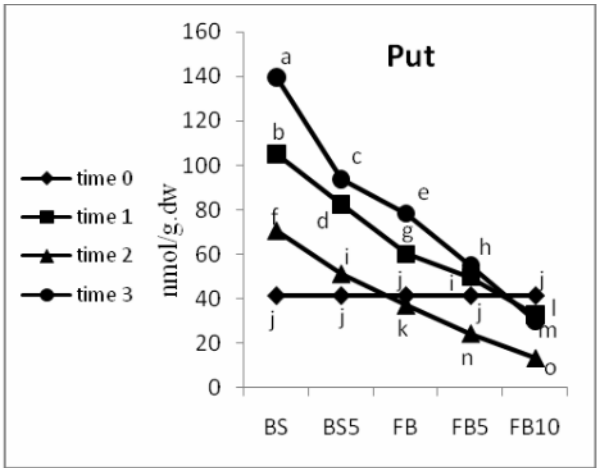

Figure-5. The effects of time and stage interactions on free Put.

The effects of time and stage interactions on free Spd

According to Figure-6, the highest content of Spd was observed in BS and time 3. The lowest content of Spd was obtained in FB10 and time 2.

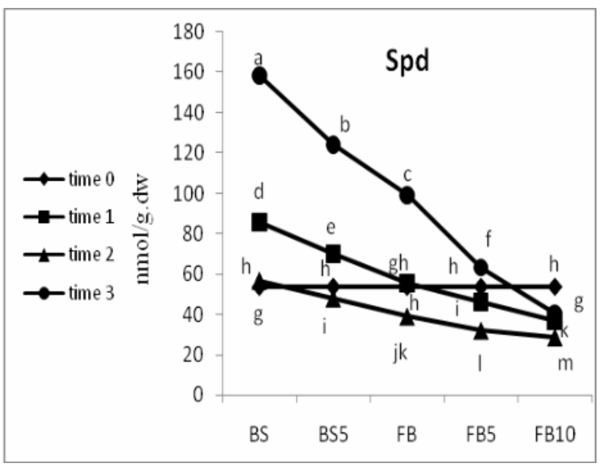

Figure-6. The effects of time and stage interactions on free Spd.

The effects of time and stage interactions on TSS

According to Figure-7, the highest percentage of TSS was observed in BS and time 3. The lowest percentage of TSS was obtained in FB10 and time 2.

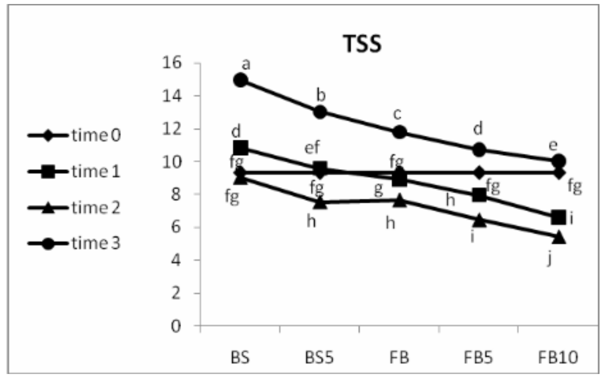

Figure-7. The effects of time and stage interactions on TSS.

The effects of time and treatment interactions on free Spm

According to Figure-8, the highest content of Spm was observed in Put 15 and time 3. The lowest content of Spm was obtained in Put 5 and time 2.

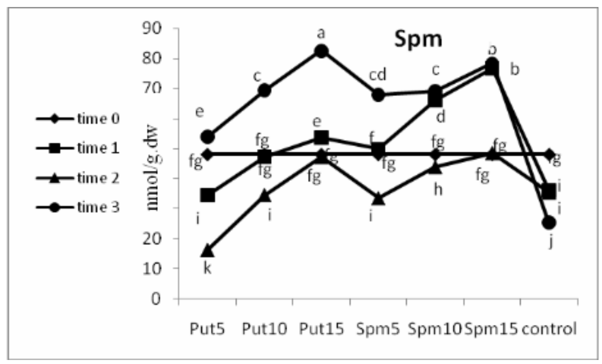

Figure-8. The effects of time and treatment interactions on Spm.

The effects of time and treatment interactions on free Put

According to Figure-9, the highest content of Put was observed in Put 15 and time 3. The lowest content of Put was obtained in Put5 and time 2.

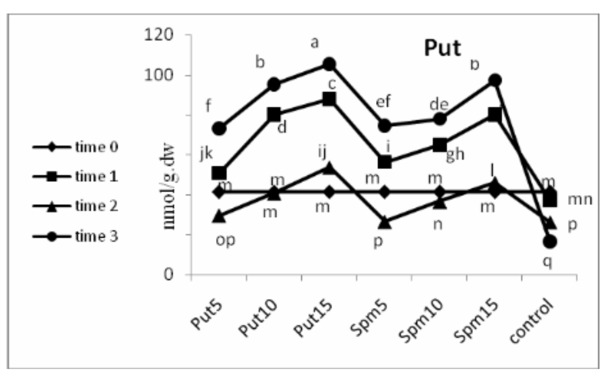

Figure-9. The effects of time and treatment interactions on Put.

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The effects of time and treatment interactions on free Spd

According to Figure-10, the highest content of Spd was observed in Spm 15 and time 3. The lowest content of Spd was obtained in Put5 and time 2.

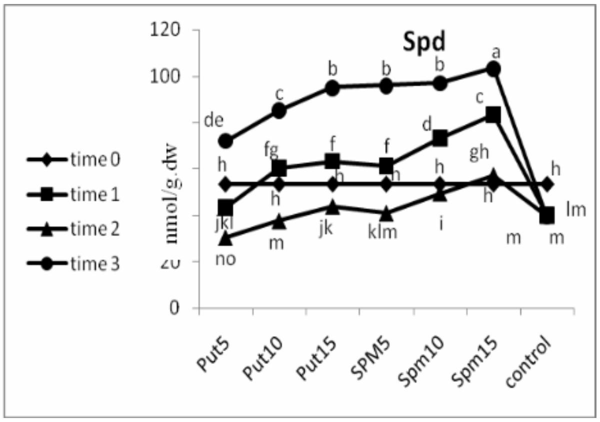

Figure-10. The effects of time and treatment interactions on Spd.

The effects of time and treatment interactions on TSS

According to Figure-11, the highest percentage of TSS was observed in Time 0 and Spm15. The lowest percentage of TSS was obtained in Spm5 and time 2.

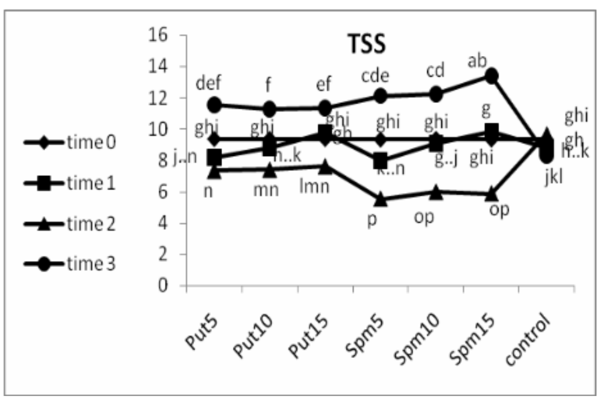

Figure-11. The effects of time and treatment interactions on TSS.

The effects of stage and treatment interactions on Free Spm

According to Figure-12, the highest content of Spm was observed in BS and Spm 15. The lowest content of Spm was obtained in FB10 and Put 5.

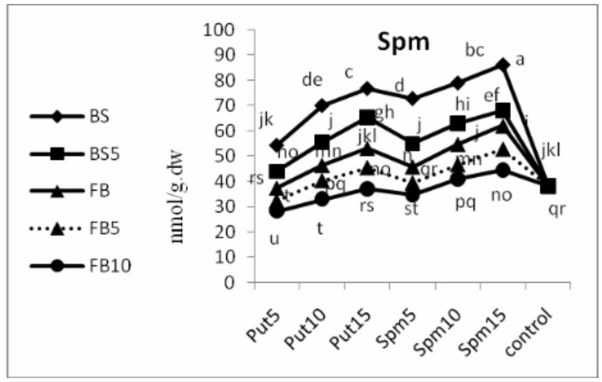

Figure-12. The effects of stage and treatment interactions on Spm.

The effects of stage and treatment interactions on free Put

According to Figure-13, the highest content of Put was observed in BS and Put 15. The lowest content of Put was obtained in FB10 and Spm5.

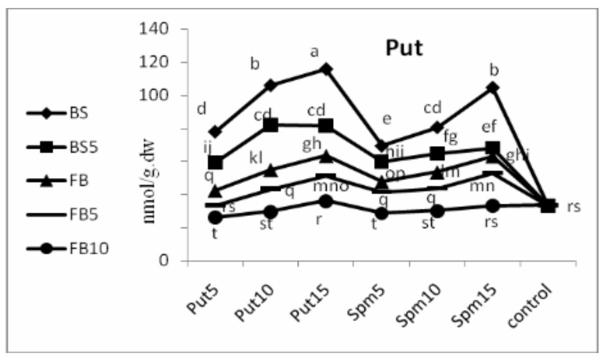

Figure-13. The effects of stage and treatment interactions on Put.

The effects of stage and treatment interactions on free Spd

According to Figure-14, the highest content of Spd was observed in BS and Spm 15. The lowest content of Spd was obtained in FB10 and Put 5.

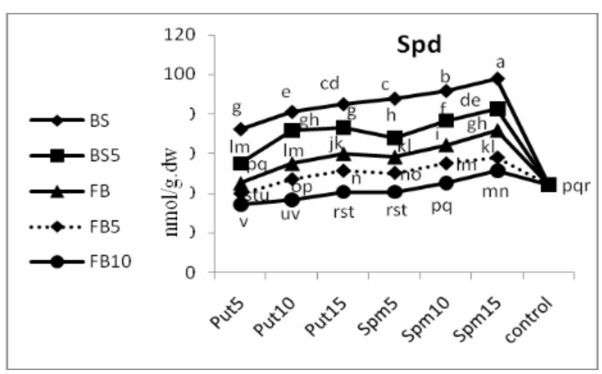

Figure-14. The effects of stage and treatment interactions on Spd.

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The effects of stage and treatment interactions on TSS

According to Figure-15, the highest content of TSS was observed in BS and Put 15. The lowest content of TSS was obtained in FB10 and Spm5.

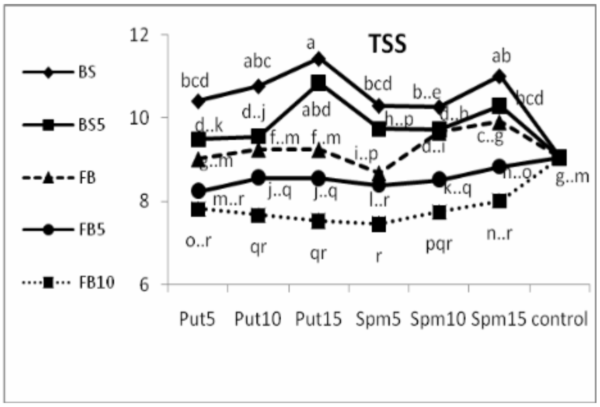

Figure-15. The effects of stage and treatment interactions on TSS.

The general positive effects observed at this study on fruit characteristics of apricot fruits as a result of applying polyamines could be attributed to enhancement effects of polyamines applications on floral developments which resulted on endogenous polyamines. In addition, accumulating evidences has showed that initial concentration of Put, Spm, Spd, and total free polyamines in the pulp and seeds were a little high for both Zoami pears and Whang Keumbea pears. It might be induced by vigorous activities of cell division in fruit at the early stage (Xu Liu *et al*., 2008). Aussanee Paksasorn *et al*. (1995) reported that polyamines have been shown to be associated with cell division during early developments, usually increasing when rapid cell division accurse. In free PAs, especially in the dominant Put the highest level was found at Full Bloom in all three cultivars, as in other plants (Shuji Shiozaki *et al*., 2002). In cultivars with high PA content in the early phase of fruit growth the fruit cell division process might be more active (Omar Franco-Moral *et al*., 2005). Spd application increases other endogenous polyamines content (Put, Spm) or (Put, Spm, Spd) in cotton leaves at both vegetative and flowering stages. The results indicate that PAs content were more enhanced in the leaves at flowering stage than vegetative stage (M.S.A. Abd El-Wahed, 2006). Canino apricot trees grown under sandy soil conditions greatly respond to foliar spraying with polyamines to enhance production and improve fruit quality (Enas A.M. Ali *et al*., 2010).

CONCLUSIONS

In conclusion, this study showed that the content of free polyamines and TSS illuminated with exogenous polyamines. These results suggest that exogenous polyamines may be an effective way for increase or decrease free polyamines which may effect on flowering and ripening. So the best treatment for increasing the content of Put, Spm and Spd was Put 15 mM /Lit, Spm15 mM /Lit, and Spm 15 mM /Lit. The best treatment for increasing the content of TSS was Spm 15 mM/Lit. Further investigation is needed to study the effect of them on flowering trees. Fruits of Apricot trees treated with both (Put) and (Spm) had a significantly higher soluble solids concentration (SSC) and it was firmer than fruits of control tree. The best time for treat Apricot trees in at Bud Stage for increasing polyamines.

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