



CHARACTERIZATION OF DIFFERENT *PISTACIA VERA* VARIETIES IN KHORASAN PROVINCE OF IRAN

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ABSTRACT

With attention to development of the *Pistacia* cultivation area in two recent decades and its economic prominence in this area, it is important selecting the best varieties with suitable quality. In this research, effects of Sefid-fiezabad, Ahmad-ghaie, Kaleghochi, Momtaz, Akbari, Fandoghi were examined in regard to farming and economical important properties. Characters such as wet cluster weight, wet nut weight, dry nut weight, half-cracked percentage, without kernel weight and kernel weight, north to south diameter, east to west diameter, canopy, total tree height, graft height and the trunk perimeter of each tree at 5 Cm before and after grafting place and leaf area. Results indicated that Akbari variety was the best and successful variety among various varieties because to have characters as high products, most kernel weight, most half-cracked percentage and most leaf areas. After that Sefid-fiezabad, Ahmad-ghaie and Kaleghochi varieties were distinguished as suitable for the south of Khorasan climates. Preference Sefid-fiezabad to Ahmad-ghaie variety for the reason that to have more kernel weight, more half-cracked, more leaf area and more products. Kaleghochi variety with that is economical for the reason that to have the least canopy, relatively top product and least without kernel rate. Momtaz variety toward low fruition that produced, having high relatively without kernel rate and not to suggest for cultivation in this climate area. Fandoghi variety had low fruition and high percent without kernel, may be that was one of low fruition pest reasons.

KEY WORDS: *Pistacia vera*, pistachio, farming character

INTRODUCTION

Pistacia vera from Anacardiaceae is a semitropical plant that is an important crop. Production of pistachio has a long and historical previous in Iran. Since 70 years before beginning of pistachio's export, this crop has found particular trade and economical value, and Iran became famous as the first and the most important country for exporting the *Pistacia*. *Pistacia* is originated from North east of Iran (Khorasan), also it is told that grafting *Pistacia* was carried from Khorasan to Kerman and Rafsanjan in Safavieh period. Until now more than 70 *Pistacia* variety have registered in Kerman. The most important *Pistacia* variety in Iran are: Akbari, Kaleghochi, Ahmad-Aghaie, Ouhadi, Zarand, Momtaz, Khanjary Damghan, Shahpasand, Sefid-posteh nogh, Ghazvini. Some variety like Phandoghi and Sefid-Fiezabad also are used in Iran. Different variety is used for increasing resistance to disease and pests, increasing product and absorption or nutrient from soil. *P. mutica* is more resistant than to *P. vera*, *P. atlantica* and *P. khinjuk* to root node nematode. *P. mutica* is important because of early flowering. It has several degree of sensibility to *Phytophthora* but it is sensitive toward *Phytophthora citrophthora*. Atli *et al.* (2002) showed that *P. atlantica* has the most diameter growth and *P. terebinthus* has the least diameter growth between *P. terebinthus*, *P. khinjuk*, *P. vera* and *P. atlantica*. Kafkas *et al.* (2006) reported that *P. atlantica* is the strongest and *P. eurycarpa* is the weakest tree between *P. terebinthus*, *P. atlantica*, *P. eurycarpa* and *P. vera*.

Esmailpour and Khezri (2006) reported that Ouhady variety had many flower buds falling but on basis of result Ak and Toker (2006) product of Ouhady was the most. On basis of Rahemi and Tavallali's results (2007), shoot growth on seedling rootstock of *P. vera* is significantly more than *P. atlantica* and *P. vera* in Ouhady and Ahmad-Aghaie. The purpose of this study was to evaluate and introduce the best variety of *Pistacia* for Khorasan and introduce garden's owners to produce crop with the best quality and quantity.

MATERIAL AND METHODS

In this study six varieties of *Pistacia* including Sefid-Fiezabad, Ahmad-Aghaie, Kaleghochi, Momtaz, Akbari and Fandoghi were used that grafted on *Pistacia* in Gonabad Bimorgh at 2003. In order to evaluate of morphological and yield characteristic, traits including cluster fresh weight, fruit fresh weight, fruit dry weight, half cracked, without kernel and kernel weight, mean of sum north to south diameter with east to west diameter, canopy, total tree height, graft height, trunk perimeter after and before grafting place and leaf area were studied. There were 40 trees of each variety. Every tree was used as a replication. First cluster fresh weight was measured. After drying fruit in natural condition, fruit dry weight was measured. Experiment was carried out in randomized Complete Block Design. SAS and Excel software were used for analyzing data. Compare mean was done using Duncan test at 0.05 level. Finally correlation coefficient was shown.

TABLE 3. Correlation Coefficient of some traits in 6 pistachio cultivars

Traits	Leaf area		Trunk perimeter after grafting place		Trunk perimeter before grafting place		Graft height	Total tree height	Canopy	North to south diameter	East to west diameter	Kernel weight	Without kernel weight	Half-cracked	Fruit dry weight	Without kernel weight	Half-cracked	Fruit dry weight	Without kernel weight	Fruit fresh weight	Without kernel weight	Half-cracked	Fruit fresh weight	Without kernel weight	Cluster fresh weight
	area	perimeter after grafting place	perimeter before grafting place	height	height	height	height	height	diameter	diameter	diameter	weight	weight	diameter	weight	weight	diameter	weight	weight	diameter	weight	diameter	weight	weight	weight
Leaf area	0.20**																								
Trunk perimeter after grafting place		0.19**																							
Trunk perimeter before grafting place			0.83**																						
Graft height				0.66ns																					
Total tree height					0.70**																				
Canopy						0.76**																			
North to south diameter							0.87**																		
East to west diameter								0.79**																	
Kernel weight									0.88**																
Without kernel weight										0.90**															
Half-cracked											0.93**														
Fruit dry weight												0.92**													
Fruit fresh weight													0.93**												
Cluster fresh weight														0.94**											

*:Significantly different at 5%, **: significantly different at 1%, ns: no significantly different at 5%

TABLE 1.

Sources	Degree freedom	Leaf area (Cm2)	Kernel weight (g)	Without kernel weight (g)	Half-cracked (%)	Fruit dry weight (g)	Fruit fresh weight (g)	Cluster fresh weight (g)
Cultivar	5	1332823437**	8200133.55**	1242666.67**	2151.68**	27617078**	64919375**	165077041.7**
Block	3	73730345ns	371743.6 ns	37564.56 ns	409.84 ns	11717272 ns	3424674 ns	7554377 ns
Error	195	97865148	369177.6	35511.49	554.03	1290013.3	4040295	9844219

Continue of Table 1. ANOVA of means square for some traits in 6 pistachio cultivars

Sources	Degree freedom	Canopy (Cm)	Trunk perimeter after grafting place (Cm)	Trunk perimeter before grafting place (Cm)	Graft height (Cm)	Total tree height (Cm)	North to south diameter (Cm)	East to west diameter (Cm)
Cultivar	5	22486.62 ns	342.16**	271.48**	1624.74 ns	20677.75**	27002.84*	30285.49**
Block	39	6988.13 ns	27.93 ns	34.83 ns	717.94 ns	3713.18 ns	6799.5 ns	6498.08 ns
Error	195	10277.44	38.28	42.64	829.75	5356.65	9925.58	9238.10

3 :Significantly different at 5%, **: significantly different at 1%, ns: no significantly different at 5%

RESULT AND DISCUSSION

Results showed that Akbari variety had the most product among the studied varieties and was significant at 0.01 level. ANOVA showed that all of the trait except graft height had significant difference at 0.01 level. Means comparison of trait at 0.05 level (Tab. 2) showed that Akbari had the most cluster fresh weight (7037.5 g) and Momtaz had the least cluster fresh weight (1300 g) that had significant difference to other variety except Fandoghi. Akbari variety had the most fruit fresh weight (4375 g) and Momtaz had the least fruit fresh weight (775 g) that had significant difference to other variety except Fandoghi variety. The highest fruit dry weight was for Akbari (2667.5 g) and Momtaz had the least fruit dry weight (357.5 g) that had significant difference to other variety except Fandoghi. Akbari variety had the most half-cracked (62.85%) and Kaleghochi had the least half-

cracked (44.57%) (Tab. 2). Akbari variety had the most without kernel weight (547.5 g) and Kaleghochi had the least without kernel weight (62.5 g) that had not significant difference to other variety except Akbari variety. Decreasing of without kernel weight is probably due to more fruit, low abortion and adoption of flowering to male variety. Entirely without kernel weight depend on variety rootstock, alternate bearing and feeding condition (Abrishami, 1995). Akbari variety had the most kernel weight (1413.2 g) that had significant difference to other variety and Momtaz variety had the least kernel weight (177.5 g). Akbari variety had the most east to west diameter (251.3 cm) that had significant difference to Kaleghochi and Momtaz varieties, and Kaleghochi variety had the least east to west diameter (178.63 cm) that had significant difference to Akbari and Sefid-iezabad varieties.

TABLE 2. Means comparison of some traits in 6 pistachio cultivars

Cultivar	Leaf area (Cm ²)	Kernel weight (g)	Without kernel weight (g)	Half-cracked (%)	Fruit dry weight (g)	Fruit fresh weight (g)	Cluster fresh weight (g)
Sefid-Faizadad	29889a	61083/6 b	150 b	60/15ab	1907/6 b	3225 b	5340b
Ahmad-aghaei	21367b	613/8 cd	125 b	58/76abc	1185 cd	2562/5bc	4225 bc
Kale-ghoochi	20375b	709/3 c	62/5 b	44/57 d	1332/5 c	2250 cd	3825 cd
Momtaz	19565b	177/5 e	137/5 b	50/53bcd	357/5e	775 e	1300 e
Akbari	31600a	1413/2 a	547/5 a	62/85 a	2667/5 a	4375 a	7037/5a
Fandoghi	18000b	392/2de	137/5b	47/58cd	722/5de	1475de	2500de

TABLE 2 Continue of Means comparison of some traits in 6 pistachio cultivars

Cultivar	Canopy (Cm)	Trunk perimeter after grafting place	Trunk perimeter before grafting place	Graft height (Cm)	Total tree height (Cm)	North to south diameter (Cm)	East to west diameter (Cm)
Sefid-Faizadad	230/63 ab	16/85 a	16/93 a	73/63 ab	190/48 ab	228 ab	233/4 a
Ahmad-aghaei	219/54ab	14/78 ab	14.03 b	76/18 a	176/63 ab	225/88 ab	213/2 ab
Kale-ghoochi	191/59b	8/65d	11/93 b	61/38 b	138/23 c	179/55 b	178/63 b
Momtaz	186/44b	11/45 cd	13/68 b	76/48a	168/3bc	186/9 b	186/98 b
Akbari	249/28a	13/10 bc	18/90 a	79/83 a	205/8 a	247/25 a	251/3a
Fandoghi	218/70ab	10/93cd	13/23b	73/25ab	176/73ab	217/43ab	219/98ab

Means with similar letters in each column are not significantly different at 5% and 1% levels (DMRT)

Akbari variety had the most north to south diameter (247.25 cm) that had significant difference to Kaleghochi and Momtaz varieties and Kaleghochi variety had the least north to south diameter (179.55 cm). Akbari variety had the most total tree height (205.8 cm) that had significant difference to Kaleghochi and Momtaz varieties. Akbari variety had the most graft height (79.83 cm) that had significant difference to Kaleghochi variety with the least graft height (61.38 cm). Akbari variety had the most trunk perimeter before grafting place (18.90 cm) and Kaleghochi variety had the least trunk perimeter before grafting place (11.93 cm) that had significant difference to Akbari and Sefid-Fiezabad varieties. Sefid-Fiezabad variety had the most trunk perimeter after grafting place (16.85 cm) and Kaleghochi variety had the least trunk perimeter after grafting place (8.65 cm) that had significant difference to Akbari, Ahmad-Aghaee and Sefid-Fiezabad varieties. This is a positive factor for *Pistacia* tree that prevents breaking tree due to sever wind. Trunk perimeter after and before grafting place increase briefly in Ahmad-Aghaee variety that it was not significant. Trunk perimeter after and before grafting place adopted in Sefid-Fiezabad variety that it was not significant.

Means comparison of overall leaf area and area of one leaf showed that Akbari (31600cm²) and Sefid-Fiezabad (29889 cm²) had the most leaf that had significant different to each other. Fandoghi had the least leaf area (18000 cm²) that had not significant difference to other variety except Akbari and Sefid-Fiezabad (Tab.2). Assessment of correlation coefficient of several traits showed that there is a positive and very significant correlation between them. There is a positive and very significant correlation between leaf area with half-cracked, north to south diameter and canopy. There is not correlation between leaf area with east to west diameter, total tree height and graft height.

Result of this study conforms to result of comparing of qualitative and quantitative characteristic of 28 varieties of pistachio in Rafsanjan. They introduced Ahmad-Aghaee as the best variety. In this study Ahmad-Aghaee had good yield too. Fandoghi had the least kernel weight. Half-cracked is a positive factor for trading of *Pistacia*. Kaleghochi had the least half-cracked and Akbari had the most. In Kaleghochi total height reduced because of shooting and decreasing apical dominance. Akbari's apical dominance is more than the other variety and caused vegetative growth. Ak and Turker (2006) reported that the most product in Ouhady and Sirt was observed on *P. khinjuk*. Other studies showed that Badami had suitable yield and quality between 20 years old rootstock. Esmailpour and Khezri (2006) showed that genetically characteristic affects on flower bud falling and alternate bearing. There was a logical relationship between leaf area and product in Ouhady that caused flower bud falling in undesirable condition. They found that there was a significant difference between Ouhady and other variety for flower bud falling and had the most apical dominance. In this study the most leaf area was observed in Akbari, so it had high photosynthesis and top product. Leaf area is used for prediction of photosynthesis and as tools for growth of crop. Therefore leaf area has a important role in products ecological theory and is a suitable index for

photosynthesis. There was an obvious relationship between leaf area and diameter growth. This result indicated that diameter growth is more than length growth, so relationship between leaf area with total height and graft height was not significant and with trunk perimeter after and before grafting place was significant. When leaf area is more than the other tree, canopy is more too. Result of this study indicated that leaf area and photosynthesis have positive effect on half-cracked and kernel weight.

CONCLUSION

Akbari variety was the best and successful scion. After it, Sefid Fiez-abad and Ahmad-aghuae varieties were suitable for grafting in Khorasan condition. Sefid Fiez-abad variety was better than Ahmad-aghuae variety because of top product, half-cracked and kernel weight. Ahmad-aghuae variety was better than Kaleghochi variety because of top product and half-cracked. Kaleghochi variety trees have low canopy, top product and kernel weight, so they are suitable for grafting. Momtaz variety produce low yield and have low kernel weight, so it dose not suggested for cultivating in this region. Fandoghi variety had low product and kernel weight that it is probably due to pests. Also Fandoghi variety was sensitive to nutrient and water shortage. Varieties in regard of leaf area are respectively: Akbary, Sefid Fiez-abad, Ahmad-Aghaee, Kaleghochi, Momtaz and Fandoghi. So it was conformed that Akbary variety was the best and successful variety among various varieties because to have characters as high products, most kernel weight, most half-cracked percentage and most leaf areas. After that Sefid-fiezabad, Ahmad-aghuae and Kaleghochi varieties were distinguished as suitable for the south of Khorasan climates.

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