Turkish Journal of Agricultural and Natural Sciences
Special Issue: 2, 2014

TÜRK
TARIM ve DOĞA BİLİMLERİ
DERGİSİ

TURKISH
JOURNAL of AGRICULTURAL
and NATURAL SCIENCES

www.turkjans.com

The Effect In The Yield And Some Quality Crıterıa Of The Planting Tımes And Pre-Treatments Tuber In The Early Potato (*Solanum tuberosum* L.)

[a]Emel KARACA ÖNER* [b]Selim AYTAÇ
[a]Ordu University, Technical Sciences Vocational Schools Ordu, Turkey
[b]University of Ondokuzmayıs, Faculty of Agriculture, Samsun, Turkey
*Corresponding author: emelkaracaoner@odu.edu.tr

Abstract

This study was conducted to determine the possibility of production of early potato in the coastal region of Middle Black Sea with respect to a line to line split-plot design with three replications in Bafra and Çarşamba locations in 2010-2011 cultivation period. In this study, Marfona and Marabel various were planted treating with different applications (Pre-shooting, Gibberellik acid-GA and control) at different dates (November, January, February, March). In Bafra and Çarşamba locations, while the highest tuber yield (kg/da) to per decare was obtained from the second and third planting dates, the lowest tuber yield was determined on the first planting date. It was determined when the planting time was retarded the correlation of tuber yield per decare and big tuber (>80gr) increased. In the result of study, in the locations of Bafra and Çarşamba, it was found the variety of Marabel (Bafra:1887.5kg/da; Çarşamba:1671.7kg/da)'s yield per plot was higher than the variety of Marfona (Bafra:1434.9kg/da; Çarşamba:1469.9kg/da). Any statistical effect of applications at the experiment year and locations was not determined; merely, pre-shooting led the increasing of tuber yield per decare. In the result of study, ıt has been concluded planting potato tubers which have been pre-shooted, will suitable in terms of tuber yield in the coastal region of Black Sea in January, February.

Keywords: Sprouting, Gibberellic acid (GA_3), Planting time, Variety

Introductıon

Turkey has suitable geographical conditions to produce potato which is grown almost every provinces. A large amount of potato product which is produced as main crop in our country, is planted wintery in terms of early product in our Mediterranean and Aegean Regions where winter passes warm. At the same time, it can be grown as a second crop in The Mediterranean climate Region at the end of summer and autumn period. Because of that, potato can be grown all the year round in Turkey (Çalışkan et al., 2010). The most advantageous aspect of early potato cultivation is to fill the field with the hoe plant which can supply high income within the winter period that there are not alternative plant much (Samancı et al., 2003). Thus, potato is presented to consumers at earlier period than the production of main potato and gained high income from it, and potatoes which are produced early period, have the potential of exportation (Samancı et al., 1988; Arıoğlu et al., 2002). Because of that potato has been just planted in Turkey's important potato cultivation region and highly big part of Europe at at the beginning of the middle of April till the time of June end which is harvest period of cultivated potato early in the season, the amount of potato decreases at these markets and correspondingly, early potato can have a market with high prices.

On the other hand, earliness and being affected from frost loss at the agricultureof early potato is the most significant subject. Earliness at the potato agriculture can be provided with selecting the earlier varietys, pre-germinating, early planting and using big tubers at the planting (Samancı et al., 1998). Because of that potato is temperate and temperate cool climate regions' plant (Arıoğlu, 2000), after planting and low temperatures at the beginning of development and high temperatures at the tuber formation stage affect development and tuber formation (Çalışkan et al., 2004). The surface component of potato plant can stand till -1.5°C, -1.7°C as to tuber till -1.4 °C, -2 °C and plant and tuber are damaged at the lower temperatures (Arıoğlu, 2000). Because of these reasons, some cultural applications as arranging well of the planting date can be beneficial to protect early potato from the frost hazard (Çalışkan, 1994). Pre-shooting, speed offshoot rising, rapid development and homogenous

product formation lead to use of seed effectively, providing a great number of stem formation per tuber. For this reason, pre-shooting of tuber seed is considered as a convenient method for the cultivation of early potato (Çalışkan et al., 2004). The cultivation of early potato both allows to be released a product to the market earlier and provides to get a higher income from the unit area. In this respect, to do agriculture of early potatos an advantage at the regions where winter passes warm. Regarding climate data in the long years (Anon, 2011) applying convenient varietys and growing methods at the coast part of Samsun come about the hypothesis of doing agriculture of early grown potato in the season November-June. This study was conducted to determine the potentiality of early potato cultivation.

Material and Method

This study which object to investigate the potentialities early potato production in coastal region of Middle Black Sea, was carried out in Çarşamba and Bafra on the behalf of coast region in 2010-2011 cultivation period.

The soils of testing area at the location of Bafra have clayed loamy (61%) structure, neutral form (pH 7.28) is calcareous at medium level (4%), non-saline (0,018%), include very high phosphrous substances (18.97 kg/da), little organic substance (1.72%). In the location of Çarşamba where the testing area was founded, it was determined that soils have loamy (44%), slight alkaline (pH 7.88), are at the medium calcareous (10.50%) and non-saline (0.43%), the content of phosphorusis high (16.35%) and organic substance is a little (1.71%).

In Bafra location within the months which was performed the test, avarage temperature values were 6.2 ^{o}C, 5.3 ^{o}C, 7.1 ^{o}C, 8.9 ^{o}C, 14.6 ^{o}C, 20.2 ^{o}C, respectively in January, February, March, April, May, June. Average temperatures which increased constantly after March, especially, after May reached the optimum levels that the potato need with regard to tuber development. Air temperature decreased under -1.5 ^{o}C accepted critic temperature value for potato one day in February (February,17/-1.9 ^{o}C). Moreover, temperatures were under 0 ^{o}C again six days in February, two days in March. In Bafra location, in the season of cultivation, monthly totals of rainfall were 122.6 mm. in January, 63.9 mm in February, 69.9 mm on March, 62.9 mm in April, 72.1 mm on May. The lowest rainfall dropped in November (7.5mm) in the experiment year.

In Çarşamba location, average temperature value in November (14.2 ^{o}C) was higher 3 ^{o}C than the averages of long years (11.2 ^{o}C) and temperature values increased as of March. In the experiment year, the lowest monthly average temperature occured in February (5.7 ^{o}C). It decreased under -1.5 ^{o}C for four days in January (january, 2(-2.7 ^{o}C), jan. 10/-3.2 ^{o}C, jan. 13/-2.9 ^{o}C, jan.14/-1.6 ^{o}C), for four days in February (feb.2/-2.5 ^{o}C, feb.5/-3 ^{o}C, feb.12,-3.6 ^{o}C, feb.17 -4.1 ^{o}C) for two days in March (march 5/-4.1 ^{o}C, march 6/-2.1 ^{o}C). Also, temperatures decreased under 0 ^{o}C for one day in November, for eleven days in January, for nine days in February, for six days in March. The lowest rain received month was November (9.9mm) within the months the test was conducted. In the study, the quantity of rain fall was extremely high (109.5mm) in June coming up with harvest time, according to the average long years (44.3).

Test was applied according to a split plot design with three replications at random blocks in line to line system. Varietys on horizantal main lines, planting dates on vertical main lines, applications on sub horizantal lines were positioned. Planting was performed 5 m long with the distance of 0.7m*0.3m to plots formed from four rows. In study, using as a material Marfona (V1) and Marabel (V2) potato varietys were planted at both two locations at four different times as November (T1), January (T2), February (T3), and March (T4). Besides, three applications were carried out treating with as pre-shooting (A1), Gibberellik acid-GA (A2) and control (A3). During every planting, CAN (26%) fertilizer at the rate of 10kg absolute nitrogen (N) was dropped off per decare. After appearing, hand hoe was done in terms of the controlling pests and neck filling. After 15-20 days from the first hoe, neck filling was repeated applying ammonium nitrate (33%) at the rate of 8 kg absolute nitrogen (N) per decare. Harvest process was put through from the beginning the middle of 2 rows remaining 0.5m distance at 5m long plots formed four rows. Thus, 5.6m field was harvested. During the harvest, at tubers obtatained from per plot; tubers under 40g were scaled as determining, small (<40g) tubers' ratios (%) were scaled as being proportioned into plot field as determining between 40-80g, medium tubers (40-80g)' ratios (%) were scaled as being proportioned into plot field

determining tubers above 80g, gross tubers (>80g)'were calculated as being proportioned into plot yield. Tuber yield (kg/da) was measured benefiting from obtained plot yield. Probable tubers'starch ratio (%) was found looking up the table (Esendal, 1990) prepeared in respect of specific gravity principle.

Obtained data was subjected to analysis of variance in accordance with line to line split plot, utilising MSTAT-C software (Gülümser et al., 2006). F test was used to specify significant grades, comparisons between average values were conducted considering Duncan test (Yurtsever, 1984). Before data entries to MSTAT-C software, Arcsiny (X+1) transformation was carried out to 0-40, 40-80 and 80>gr tubers'ratios. After Duncan multi-comparison test, 0-40,40-80 and 80> tubers'weights were situated to tables as being converted data into original values.

Results and Discussion

Small (<40g) tuber ratio (%): At cultivation early potato, in Bafra location, statistically, the difference was found significant ($p<0.05$) between the varietys with regard to small tuber(<40g) ratio. Small tubers (<40g)'ratios were determined in Marfona variety as 31.6% while 29.3% in Marabel (Table 1). Varying small tuber (<40g) ratio between the varietys were based on varietys genetic and interaction of variety*environment (Arıoğlu, 1986). In total tuber yield, tubers ratios which were classified small tuber (<40g) was affected from planting times highly significant ($p<0.01$) at Bafra location (Table 1). Small tuber (<40g) ratio was found most at the first planting time, and it decreased at planting times after the first planting time (Table1). Our findings in Bafra location has shown parallelism with Çalışkan (1994)'s findings which he has reported that avarage small tuber ratio has been higher at first planting time (November, 15) between on November 15, December 5 and 25, and January 15 than other plantig times.

Statistically, the effect of applications on small tuber (<40g) ratio was found significant ($p<0.01$) (Table 1). It was found that tubers ratios smaller than 40g was 36.8% at GA application, 28.7 % at pre-shooting and 25.9% at control (Table1). Our results were reinforced with Yılmaz and Kahraman (2006)'s findings reporting that GA reduced tuber yield in Morfana, rising GA doses rose the decline of tuber yield, although GA generally stimulated growing potato, this stimulating property did not reflect to tuber yield. Inasmuch as, it can be said that to rise small tuber ratio may cause to decrease tuber yield.

The interaction of variety*planting time affected the small tuber (<40g) ratios statistically ($p<0.05$). The alteration of tubers ratios smaller than 40g were found 16.1%(V1T4)-54.6%(V2T1). Small tubers ratios decreases along with Marfona variety planting time. Tuber ratios smaller than 40g continued to decrease till third planting time then increased with the fourth planting time at Marabel (Table1).

The part of study in Çarşamba location, small tubers ratios (40g) was found 29.9 % in Marfona and 28.9% in Marabel at cultivation period (Table2).

In Çarşamba location, small tubers (<40g) ratios affected from planting times highly significant ($p<0.01$). Small tubers (<40g) were obtained most from first (T1) planting with 51.8 %; avarage values of small tubers were found close to each other at T2, T3, T4 planting times (Table2).

Medium (40-80g) Tuber Ratio (%): The part of study in Bafra location, the effect of varietys and planting times on medium tuber (40-80) was found significant ($p<0.05$) statistically at early potato cultivation.

In Bafra location, tuber ratio between 40-80g was found 38.1% in Marfona, 35.6% in Marabel for early potato cultivation (Table1). Cerit (2010) and Çalışkan (1994) have determined significant differences between varietys in terms of medium tuber ratio in their studies parallely in our study. Also, Çalışkan (1994) have reported coming about differences between varietys in terms of medium tuber ratio may correlate with that varietys have different development periods. In cultivation period, that mid-early cultivar Marfona need longer development period comparing early cultivar Marabel, that tuber development come about longer may have led what this variety medium tuber ratio has been high at the same harvest date. Pehluvan et al., (2006) who have ascertained that medium tuber ratio has been 33.3% in Marfona, have strengthened our study results.

In Bafra location, medium tubers (40-80g) ratios changed between 32.1% (T4) and 41.8% (T2) (Table1).

The part of study in Çarşamba location, any effect of processes being mentioned in our

study on medium tuber (40-80) ratio was not found stastistically. Tubers ratios between 40-80g were determined as 36.5% for both two varietys. The alteration tuber ratio between 40-80g came about between 32.6% (T3) and 39.7% (T4) in the study (Table 2).

Big (>80g) Tuber Ratio (%): In the part of study in Bafra location, the effects of planting times ($p<0.01$), the interaction of variety*planting time ($p<0.05$) and applications ($p<0.01$) on big (>80g) tuber ratio were found significant at early potato cultivation.

In Bafra location, big tubers ratios were found as 30.2 % in Marfona and as 35.2% in Marabel for early potato cultivation (Table1).

The lowest ratio of big tubers (>80g) was obtained from the first planting and tubers ratios increased with retarding planting times. The alteration of big tubers ratios appearred between 11% (T1) and 49.8% (T4) according to planting times (Table1). Our findings show parallellism with Çalışkan (1994)'s findings which have shown big tuber ratio increased highly significant when planting time passes, planted on November 15, December 5 and 25, and January 15. Taja et al., 1985 and Rıoux et al.,1982 have reported planting time affect marketable tuber ratio in different rates.

When analyzed the effect of applications on big (>80g) tuber ratio, it was found 26.5% at GA, 32.9% at pre-shooting and 38.7% at control (Table1). The interaction variety*time, the alteration of big (>80g) tuber ratio were determined between 9.4% (V2T1) and 51.8% (V1T4) in cultivating period (Table1). When Marfona planting time passed, big (>80g) tubers ratios increased. For Marabel, big tubers ratios increased till the third planting time, but the interaction of variety*time appeared because of decreasing a little bit at the forth planting time.

In Çarşamba location, big tubers ratios were found as 33.6% for Marfona,34.6% for Marabel (Table2). At the part of study in Çarşamba location, the significant ($p<0.01$) effect of planting times on tubers bigger than 80g was found. Big tuber ratio incresed till the third planting time, but decreased at the fourth one. Big tubers ratios were ranged as T3 (46.4%), T2 (40.2%), T4 (37.3%), T1(12.4%) in terms of planting time (Table2).

Tuber Yield (kg/da: In Bafra location, for early potato cultivation, tuber yield was found as 1434.9kg/da in Marfona and 1887.5kg/da in Marabel (Table3). The differences of varietys tuber yields are based on their genetics and differentiating their reactions to different environment conditions (Çalışkan, 1994). Studies conducted on this subject, showed there was a difference between varietys in terms of tuber yield. Yield which is a quantitative characterictic varies highly depending on many factors such as agronomical applications, besides varietys genetics,climate and soil conditions used input quantity and quality (Pehluvan et al., 2006).

In the part of study in Bafra location, for early potato cultivation, The highly significant ($p<0.01$) effect of only planting times on tuber yield was found. At the cultivation period, tuber yield was obtained as 2098.7kg/da from T3 planting, 1933.2kg/da from T2 planting, 1666.4kg/da from T4 planting, 946.3kg/da from T1 planting (Table 3). Sögüt et al., 2005, in their study conducted under early production conditions in Diyarbakır, have reported tuber yield has been affected highly significant ($p<0.01$) by planting times and it has been 804.9-1423.6kg/da in terms of planting times. Researchers' data related with tuber yields per decare are partly similar with data obtained from our study. In our study, avarage tuber yields increased depending on retarding the planting dates. Çalışkan (1994) stated tuber yield increased parallelly retarding planting dates which planted on November 15, December 5 and 25, January 15 in Adana. Our results show parallellism with researcher's data. In our study, tuber yield decreased at the fourth planting time. Harvest process at the fourth planting time occured at first year on July 19, at second year on June 30. In experimental period, temperatures reached above 20c both two years on June and July. Our findings are in accord with Vayda (1994)'s findings which shows various environmental stress conditions have decreased potato's total and marketable tuber yield.

In Çarşamba location, tuber field was found as 1469.9kg/da in Marfona and 1671.7kg/da in Marabel (Table3).

In study's Çarşamba location, the highly significant ($p<0.01$) effect of only planting times on tuber yield was determined. Tuber yields were obtained as 2131.1kg/da from T2 planting, 2059.8kg/da from T3, 1390.7kg/da from T4, 701.6kg/da from T1 (Table3). Tuber yield values decreased at this cultivation period after second planting time. Sögüt et al., 2005, in their study conducted under early production conditions in Diyarbakır, have reported tuber yield has been

affected highly significant ($p<0.01$) by planting times and it has changed between 804.9-1423.6kg/da in terms of planting times.

Starch ratio (%): In Bafra location, any processes' effect on starch ratio was found insignificant statistically.

In Bafra location, starch ratios obtained from Marfona and Marabel varietys were found 19.40% and 14.94% respectively (Table4). Starch ratios altered between 14.52% (T2) and 15.82% (T3) according to planting times. In our study. findings related with starch ratio values were found higher than the one between 12.4-13.2% obtained on potato tuber in second growth conditions in Menemen (Çalışkan et al., 1999) and the one obtained between 12.3-12.9% at early production conditions in Southeastern Anatolia Region (Sögüt et al., 2005). This case may stem from differentiating used varietys of genetics, climate conditions at production regions and varietys treatments shown to environmental conditions. Since potato is a sensitive plant to environmental conditions. Same varietys show different morphological properties at different regions, and alter in terms of quality properties and tuber yields (Vayda, 1994).

In Çarşamba location, as shown at table 4, avarage starch ratios were determined as 20.55% in Marfona and 21.12% in Marabel. For Çarşamba and Bafra locations our findings were in the limits determined by Esendal (1990) who classified starch ratios at potato tubers that having starch ratio till 12% is low, 13-15% medium, 16-19% high, higher than 19% very high. Also, Yılmaz and Güllüoğlu (2002) who reinforced our study results reported quality criteria such as starch and dry substance ratios are closely related with ecological factors and vegetation duration.

At cultivation period, the highest starch ratio (20.89%) was obtained from first planting in Çarşamba location (Table4). In our study our findings related with starch ratio has been higher than the values of Çalışkan et al., (1999) between 12.4-13.2%. This case may stem from differentiating used varietys of genetics, climate conditions at production regions and varietys treatments shown to environmental conditions.

When being analyzed starch ratio, starch contents obtained from different applications were found close each other. In study, an alteration was found between the range of 20.54% (pre-shooting)-21.35% (GA) (Table4). Çalışkan et al.(1997) determined starch ratio between 11.9-13.8% in terms of different GA dose and application times, and the highest starch ratio with non-applied tubers with 5ppm GA dose.

Conclusıon

In the conclusion of this study, in Bafra and Çarşamba locations, Marabel can be suggested as a convenient variety for early cultivation, because Marabel's yield (Bafra:1887.5kg/da; Çarşamba: 1671.7 kg/da) per decare werefound higher than Marfona (Bafra:1434.9 kg/da; Çarşamba: 1469.9 kg/da).

In Bafra location, it was found that while the lowest tuber yield per decare was obtained at the first planting, the highest one was obtained at the third planting, and tuber yield per decare and big tubers (>80g) ratios increased with retarding planting time. Also, early cultivation can be suggested at second (January) and third (February) plantig times which potatoes harvested, can be presented to the market early and the prices of potatoes are higher because of that the highest gross income is obtained per decare. At Çarşamba location, tuber yield increased per decare with retarding planting date. The highest yield per decare was obtained at the third planting and second planting time followed that. Planting in January and February can ce suggested for Çarşamba location.

Any statistical effect of applications on tuber yield per decare was not found, but tuber yield per decare increased at plots performed pre-shooting at both these locations. Tuber yield per decare was in decline at plots being applied GA was found.

In the conclusion; it was found that expected yield values were not reached from November plantings for early potato agriculture in the coastal region of Black Sea, pleasant yield was gained from plantings in January and February applying pre-shooting, from being used two varietys Marabel stood out more. However, it is concluded to conduct the study longer with lots of varietys placed at different formation groups in different locations will be beneficial to obtain more certain data.

Table 1: The Obtained mean values (%) with respect to the effects of different application, variety and planting times on small tuber (<40 g) ratio (%), medium tuber (40-80 g) ratio (%) and big tuber (>80 g) ratio (%) and statistical groups obtained according to Duncan Multiple Range test at Bafra location.

Bafra Location													
Variety	Planting Time	Small (<40g) Tuber Ratio (%)				Medium (40-80g) Tuber Ratio (%)				Big (>80g) Tuber Ratio (%)			
		A1	A2	A3	VxT Ort.	A1	A2	A3	VxT Ort.	A1	A2	A3	VxT Ort.
Marfona (V1)	T1	48.3	57.3	48.7	51.4 **B**	42.3	34.0	32.0	36.1	9.4	8.7	19.3	12.5 G
	T2	40.3	33.0	30.7	34.7 **C**	46.3	39.3	45.3	43.7	13.0	28.3	24.0	21.8 F
	T3	19.7	34.0	19.0	24.2 **E**	42.0	43.0	37.7	40.9	38.3	22.7	43.7	34.9 D
	T4	10.3	24.7	13.3	16.1 **G**	29.3	39.0	27.3	31.9	59.7	36.3	59.3	51.8 A
	VxA Ort.	29.7	37.3	27.9	**31.6 A**	40.0	38.9	35.6	**38.1 A**	30.1	24.0	36.6	**30.2**
Marabel (V2)	T1	60.0	60.0	43.7	54.6 **A**	33.3	32.3	42.3	36.0	6.3	7.7	14.3	9.4 H
	T2	20.7	37.7	19.3	25.9 **D**	43.3	38	38.3	39.9	35.7	24.3	41.7	33.9 E
	T3	15.7	19.7	14.7	16.7 **G**	41.0	35.0	26.3	34.1	43.3	45.3	59.7	49.4 B
	T4	14.7	27.7	17.7	20.0 **F**	28.0	34.3	35.0	32.4	57.7	38.3	47.7	47.9 C
	VxA Ort.	27.8	36.2	23.8	**29.3 B**	36.4	34.9	35.5	**35.6 B**	35.8	28.9	40.8	**35.2**
Average (A)		28.7 B	36.8 A	25.9 C		38.2	36.9	35.5		32,9 B	26.5 C	38.7 A	
		$LSD_{0.01}$ Uyg= 0.7294 **$LSD_{0.05}$ Ç x Z= 0.6464**				**$LSD_{0.05}$ Çeşit= 1.878**				**$LSD_{0.05}$ Ç x Z= 0.8701** **$LSD_{0.01}$ Uyg= 0.6746**			

V x A Interaction Table												
	Small (<40g) Tuber Ratio (%)				Medium (40-80g) Tuber Ratio (%)				Big (>80g) Tuber Ratio (%)			
Planting Time	Applications			Planting Time Averages	Applications			Planting Time Averages	Applications			Planting Time Averages
	A1	A2	A3		A1	A2	A3		A1	A2	A3	
T1	54.2	58.7	46.2	53.0 **A**	37.8	33.2	37.2	36.1 **C**	7.9	8.2	16.8	11.0 D
T2	30.5	35.3	25.0	30.3 **B**	44.8	38.7	41.8	41.8 **A**	24.3	26.3	32.8	27.8 C
T3	17.7	26.8	16.8	20.4 **C**	41.5	39.0	32.0	37.5 **B**	40.8	34.0	51.7	42.1 B
T4	12.5	26.2	15.5	18.0 **D**	28.7	36.7	31.2	32.1 **D**	58.7	37.3	53.5	49.8 A
	$LSD_{0.01}$ Zaman= 0.3624				**$LSD_{0.05}$ Zaman= 0.4135**				**$LSD_{0.01}$ Zaman= 0.7894**			

Aynı harfle gösterilen değerler kendi grubunda, istatistiki açıdan (% 5 veya 1) farksızdır.

Table 2: The Obtained mean values (%) with respect to the effects of different application, variety and planting times on small tuber (<40 g) ratio (%), medium tuber (40-80 g) ratio (%) and big tuber (>80 g) ratio (%) and statistical groups obtained according to Duncan Multiple Range test at Çarşamba location.

Çarşamba Location													
Variety	Planting Time	Small (<40g) Tuber Ratio (%)				Medium (40-80g) Tuber Ratio (%)				Big (>80g) Tuber Ratio (%)			
		A1	A2	A3	VxT Ort.	A1	A2	A3	VxT Ort.	A1	A2	A3	VxT Ort.
Marfona (V1)	T1	45.7	63.7	44	51.1	45	27.3	35.7	36	9.7	8.7	20.7	13
	T2	21.7	24	25.3	23.7	35.7	41.7	38.3	38.6	42.7	34.7	36.3	37.9
	T3	25	19.3	25.7	23.3	38	34	34.3	35.4	36.7	47	40	41.2
	T4	17.7	28	18.7	21.4	37	41	30	36	45.3	30.7	51	42.3
	VxA Ort.	27.5	33.8	28.4	**29.9**	38.9	36	34.6	**36.5**	33.6	30.3	37	**33.6**
Marabel (V2)	T1	53	61.3	43	52.4	36	31.3	40	35.8	11	7.3	17	11.8
	T2	18.3	21	20.7	20	34	42	35.3	37.1	47.3	36.7	43.3	42.4
	T3	15.7	15.7	25	18.8	31.7	27	30.3	29.7	53	57.3	44.7	51.7
	T4	26.7	23.7	22.3	24.2	46.3	45.3	38.7	43.4	27	31.3	38.7	32.3
	VxA Ort.	28.4	30.4	27.8	**28.9**	37	36.4	36.1	**36.5**	34.6	33.2	35.9	**34.6**
Average (A)			32.1	28.1		38	36.2	35.3		34.1	31.7	36.5	

V x A Interaction Table												
	Small (<40g) Tuber Ratio (%)				Medium (40-80g) Tuber Ratio (%)				Big (>80g) Tuber Ratio (%)			
Planting Time	Applications			Planting Time Averages	Applications			Planting Time Averages	Applications			Planting Time Averages
	A1	A2	A3		A1	A2	A3		A1	A2	A3	
T1	49.3	62.5	43.5	51.8 **A**	40.5	29.3	37.8	35.9	10.3	8	18.8	12.4 **B**
T2	20	22.5	23	21.8 **B**	34.8	41.8	36.8	37.8	45	35.7	39.8	40.2 **A**
T3	20.3	17.5	25.3	21.1 **B**	34.8	30.5	32.3	32.6	44.8	52.2	42.3	46.4 **A**
T4	22.2	25.8	20.5	22.8 **B**	41.7	43.1	34.3	39.7	36.2	31	44.8	37.3 **A**
	$LSD_{0.01}$ Zaman= 1.227								**$LSD_{0.01}$ Zaman = 2.053**			

Aynı harfle gösterilen değerler kendi grubunda, istatistiki açıdan (% 5 veya 1) farksızdır.

Table 3: The Obtained mean values (%) with respect to the effects of different application, variety and planting times on tuber yield (kg/da) and statistical groups obtained according to Duncan Multiple Range Test for Bafra and Çarşamba locations.

Tuber Yield (kg/da)									
Variety	Planting Time	Bafra Location				Çarşamba Location			
		A1	A2	A3	VxT Ort.	A1	A2	A3	VxT Ort.
Marfona (V1)	T1	343.9	537.9	1116.4	666.0	491.7	272.7	784.2	516.2
	T2	1251.1	2077.7	1581.1	1636.6	1895.4	2193.5	1772.9	1953.9
	T3	2035.6	1525.9	1951.4	1837.6	1692.3	1796.4	2069.0	1852.6
	T4	1706.0	1482.7	1609.2	1599.2	1147.5	1435.2	2087.9	1556.9
	VxA Ort.	1334.1	1406.0	1564.5	**1434.9**	1306.7	1424.5	11678.5	**1469.9**
Marabel (V2)	T1	1128.9	1033.0	1518.6	1226.8	812.7	665.6	1182.5	886.9
	T2	2457.1	1857.1	2375.5	2229.9	2426.3	1723.4	2775.0	2308.2
	T3	2221.8	2317.3	2540.5	2359.8	2323.2	2327.9	2150.0	2267.1
	T4	1911.4	1400.8	1888.2	1733.5	1410.6	1195.6	1067.4	1224.5
	VxA Ort.	1929.8	1652.0	2080.7	**1887.5**	1713.2	1478.1	1793.7	**1671.7**
Average (A)			1529.0	1822.6		1524.9	1451.3	1736.1	

V x A Interaction Table

	Bafra Location				Çarşamba Location			
Dikim Zamanı	Applications			Planting Time Averages	Applications			Planting Time Averages
	A1	A2	A3		A1	A2	A3	
Z1	736.4	785.4	1317.5	946.3 B	652.2	469.2	983.4	701.6 C
Z2	1854.1	1967.4	1978.3	1933.2 A	2160.8	158.5	2273.9	2131.1 A
Z3	2128.7	1921.6	2245.9	2098.7 A	2007.7	2062.2	2109.5	2059.8 A
Z4	1808.7	1441.7	1748.7	1666.4 AB	127.0	1315.4	1577.7	1390.7 B
	$LSD_{0.01}$ Zaman=818.4							

Table 4: The Obtained Means (%) with respect to the effects of different application, variety and planting times on starch ratio (%) and statistical groups obtained according to Duncan Multiple Range Test for Bafra and Çarşamba locations.

Starch Ratio (%)									
Variety	Planting Time	Bafra Location				Çarşamba Location			
		A1	A2	A3	VxT Ort.	A1	A2	A3	VxT Ort.
Marfona (V1)	T1	13.8	13.37	14	14.39	24.05	21.57	22.47	22.69
	T2	16.17	15	13.3	14.82	20.23	21.67	21.27	21.06
	T3	16.43	17.03	14	15.82	20.77	19.43	21.03	20.41
	T4	14.13	13.9	15.8	14.61	18.97	16.07	19.13	18.06
	VxA Ort.	15.13	15.33	14.28	**14.91**	21	19.68	20.98	**20.55**
Marabel (V2)	T1	13.37	15.63	15.4	14.8	19.07	24.9	21.07	21.68
	T2	13.1	14.87	14.67	14.21	20.97	21.1	17.93	20
	T3	15	16.3	16.13	15.81	19.87	20.7	21.4	20.66
	T4	13.63	15.63	15.5	14.92	20.4	25.37	20.7	22.16
	VxA Ort.	13.78	15.61	15.43	**14.94**	20.08	23.02	20.28	**21.12**
Average (A)			15.47	14.85			20.54	21.35	20.63

V x A Interaction Table

	Bafra Location				Çarşamba Location			
Dikim Zamanı	Applications			Planting Time Averages	Applications			Planting Time Averages
	A1	A2	A3		A1	A2	A3	
Z1	13.58	15.5	14.7	14.59	21.56	23.23	21.77	22.19
Z2	14.63	14.93	13.98	14.52	20.6	21.38	119.6	20.53
Z3	15.72	16.67	15.07	15.82	20.32	20.07	21.22	20.53
Z4	13.88	14.77	15.65	14.77	19.68	20.72	19.92	20.11

References

Anonim. 2011. Samsun Directorate of Meteorology Records

Arıoğlu, H. 1986. Çukurova turfanda patates yetiştiriciliğinde farklı kökenli patates çeşitlerinin verim ve tarımsal özellikleri üzerinde bir araştırma. Doğa Tr. Tar. Or. Seri D, 10 (2): 141-148.

Arıoğlu, H. 2000. Nişasta ve Şeker Bitkileri. Ç.Ü. Ziraat Fakültesi Genel Yayın No: 188. Ders Kitabı No: A-57, Adana, 234 s.

Arıoğlu, H., İncikli, H., Zaimoğlu, B. ve Güllüoğlu, L. 2002. Çukuruova bölgesinde turfanda patates yetiştiriciliği üzerinde araştırmalar. III. Ulusal Patates Kongresi, 23-27 Eylül İzmir, s. 381-390.

Cerit, C.S. ve Kaynak, M.A. 2010. Turfanda patates (Solanum tuberosum L.) yetiştiriciliğide bazı çeşitlerin verim ve verim unsurlarının saptanması. ADÜ Ziraat Fakültesi Dergisi, 7(2): 111-116.

Çalışkan, M.E. 1994. Çukurova koşullarında farklı yetişme süresine sahip bazı patates (Solanum tuberosum L.) çeşitlerinin değişik dikim zamanlarına göre erkencilik özellikleri ile yumru verimlerinin belirlenmesi üzerine bir çalışma. Ç.Ü. Fen Bilimleri Enstitüsü. Tarla Bitkileri Anabilim Dalı Yüksek Lisans Tezi, 86 s, Adana.

Çalışkan, C.F., Yıldırım, M.B., Çaylak, Ö., Budak, N. ve Yıldırım, Z. 1997. Ana ürün olarak dikimi yapılan değişik olumlu bazı patates çeşitlerinde kısa intervali dikim periyotlarının çeşitlerin fizyoloji, verim ve kalite üzerine etkileri. Türkiye II. Tarla Bitkileri Kongresi, 22-25 Eylül, Samsun, s. 279-282.

Çalışkan, C.F., Yıldırım, M.B., Çaylak, Ö. ve Yıldırım, Z. 1999. ikinci ürün olarak dikimi yapılan değişik olumlu bazı patates çeşitlerinde kısa intervalli dikim periyotlarının çeşitlerin fizyoloji, verim ve kalite özelliklerine etkileri. II. Ulusal Patates Kongresi, 28-30 Haziran, Erzurum, s. 227-232.

Çalışkan, M.E., Çalışkan, S. ve Arıoğlu, H. 2004. Efeects of presprouting and planting date on growth and yield of potato crop ın mediterranean type environment. Agronomy Section Meeting of European Association for Potato Research, 23-27 June, Mammaia, Romania, pp.189-196.

Çalışkan, M.E., Onaran, H. ve Arıoğlu H. 2010. The overviev to the turkish potato sector: challenges, achievements and expectation. Potato Agrophysiology, Proceedings of the International Symposium on Agronomy and Physiology of Potato, 20-24 September, Nevşehir, Turkey, s. 1-11.

Esendal, E. 1990. Nişasta Şeker Bitkileri ve Islahı. OMÜ Ziraat Fakültesi Genel Yayın No: 49. Cilt:1, Patates, Samsun, 221 s

Gülümser, A., Bozoğlu, H. ve Pekşen, E. 2006. Araştırma ve Deneme Metotları. OMÜ, Ziraat Fakültesi Yayınları. Ders Kitabı No: 48, Samsun, 264 s.

Pehluvan, M., Kaya, C., Dizikısa, T., Kumlay, A.M., Tozlu, E. ve Okçu, M. 2006. Bazı patates çeşitlerinin Erzurum-Pasinler ekolojik koşullarına uyumu. IV. Ulusal Patates Kongresi, 06-08 Eylül, Niğde, s. 98-102.

Rıoux., R., Gosselın, J. ve Genereux, H. 1982. Effect of planting date on poatatoes grown ın short seasons. Field Crop Abs., 35(2): 171.

Samancı, B., Özkaynak, E. ve Tuğrul, S. 1998. Turfanda patates (Solanum tuberosum L.) üretiminde farklı bitki sıklığının bazı agronomik özellikler üzerine etkisi. Ondokuz Mayıs Üniv. Zir. Fak. Dergisi, 13(2): 79-85.

Samancı, B., Özkaynak, E. ve Çetin, M.D. 2003. Antalya koşullarında turfanda patates (Solanum tuberosum L.) yetiştiriciliğinde bazı çeşitlerin verim ve verim ile ilgili özelliklerinin belirlenmesi. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 16(1): 27-33.

Söğüt, T., Öztürk, F. ve Temiz, M. 2005. Güneydoğu Anadolu bölgesi koşullarında turfanda patates (Solanum tuberosum L.) üretim olanakları. Türkiye VI. Tarla Bitkileri Kongresi, 5-9 Eylül, Antalya, s. 351-356.

Taja, H., Cadorna, A., Suetos, D., Acasıo, R. ve Zaag, P. V. 1985. Potato (Solanum tuberosum L.) tuber yield in cagayan ınfluenced by planting date mulcing and location. Field Crop Abst., 38(12): 865.

Vayda, M.E. 1994. Environmental stress and ımpact on potato yield. potato genetics. Edited by Bradshaw, J.E., Mackay, G.R. Page: 239-261.

Yılmaz, H.A. ve Güllüoğlu, L. 2002. Harran ovası koşullarında yetiştirilen kimi patates çeşitlerinin (Solanum tuberosum L.) tarımsal ve bazı özellikleri üzerinde bir araştırma. III. Ulusal Patates Kongresi, 23-27 Eylül, İzmir, s. 179-192.

Yılmaz, G. ve Kahraman F. 2006. Patates tarımında büyüme düzenleyici bazı kimyasalların etkilerinin incelenmesi. IV. Ulusal Patates Kongresi, 06-08 Eylül, Niğde, s. 64-68.

Yurtsever, N. 1984. Deneysel İstatistik Metotlar. T.C. Tarım Orman ve Köyişleri Bakanlığı Köy Hizmetleri Genel Müdürlüğü Yayınları. Genel Yayın No: 121. Teknik Yayın No: 56, Ankara.