

PERIODIC GROWTH AND DEVELOPMENT OF FRUITS OF DIFFERENT DATE CULTIVARS GROWN UNDER THE AGRO-CLIMATIC CONDITIONS OF D. I. KHAN

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ABSTRACT: A research trial was conducted in the orchard of Horticulture Department at Faculty of Agriculture, Gomal University, D.I.Khan during 2010 to study the periodic growth and development of fruits of five promising date cultivars. The cultivars were included Dhakki, Gulistan, Khudrawi, Shakri and Zaidi-1. Fruits were collected at the intervals of 15 days (i.e 5th May, 20th May, 5th June, 20th June, 5th July, 20th July and 5th August) for determining their physical characteristics (weight, length, weight of pulp/ flesh, stone weight) and also data were recorded on fruit set percentage and fruit yield/plant (kg). The significantly highest fruit weight (11.20 gm), length (35.87 mm) and pulp weight (10.47 gm) were recorded in Dhakki succeeded by Gulistan. Cultivars differed significantly with respect to average weight of stone. The significantly highest stone weight was recorded in Gulistan followed by Dhakki and lowest in Zaidi-1. However, the highest fruit set of 93.0% was recorded in Gulistan followed by Dhakki, Zaidi-1, Khadrawi and Shakri with fruit set of 92.05%, 89.0%, 86.0% and 78.0% respectively. The significantly highest fruit yield/plant (97.59 kg) was recorded in cv Dhakki followed by Gulistan (86.75 kg/ plant), Zaidi-1 (62.25 kg/plant), Khudrawi (62.00 kg/plant) and Shakri (57.80 kg/plant). Amongst the cultivars Dhakki ranked first in earning better return in terms of yield as compared to Gulistan and Khudrawi.

Key words: Fruit set, fruit weight, dhakki, periodic growth, D. I. Khan.

INTRODUCTION

The date palm is a popular human food and passes through four different stages from fruit setting to maturity. The physical changes periodically occur at various maturity stages have been reported by various researchers (Myhara *et al.*, 1999; Elahmer *et al.*, 2007) whom conducted a research on date palm cultivars for their physical composition. Iqbal *et al.* (2011) determined the physical characteristics of fruit of date cultivars grown in D.I.Khan division. Soliman (2006) evaluated and compared date palm cultivars. Jahromi *et al.* (2008) determined physical properties of Shahani date fruit in Iran. Iqbal *et al.* (2008) studied the significant effect of male pollinizers on fruit characteristics, viz., fruit weight, fruit length, fruit breadth, fruit pulp weight, seed weight and yield index of two date palm cultivars of Zahidi and Dhakki at Dera Ismail Khan. Al-Qureshi (2010) studied the physical changes in 'Helali' date palm fruit during development and ripening in two successive seasons and resulted that fruit, flesh weight, and length were gradually increased during development until 17 weeks. Mertia *et al.* (2010) revealed significant variations in physical characteristics of fruits of six prominent cultivars of dates.

The agro-climatic conditions prevailing in D. I. Khan district are congenial for growing all kinds of dates (Iqbal *et al.*, 2011). Different cultivars namely Dhakki,

Gulistan, Shakri, Zaidi-1, Zaidi-II, Khudrawi, Basra, Helini, Zahidi, Muscat and Hillawi are under cultivation in D. I. Khan. Among these Dhakki, Gulistan, Shakri, Zaidi and Khudrawi are prominent cultivars and mostly cultivated. Date flesh would also serve as good source of fish feed additives, while its seeds would best be used as a source of energy for improved feed utilization efficiency (Sotolu *et al.*, 2011). Several researchers (Ramdevputra *et al.* 2009; Osman, 2008; Marashi and Mousavi, 2007; Chandra and Chaudhary, 1996) have studied the physico-chemical characteristics of date cultivars. In the present study research the periodic growth and development of fruits of five promising date cultivars grown in the orchard of Horticulture Department at Faculty of Agriculture, Gomal University, D. I. Khan were studied.

MATERIALS AND METHODS

A research trial was conducted in date palm orchard of Horticulture Department at Faculty of Agriculture, Gomal University, D. I. Khan during 2010. Date palm trees of five promising date cultivars were selected for studying the periodic growth and development of their fruits. The date varieties were pollinated with single male. Three trees of each cultivar were chosen for study and their fruits were collected at

the intervals of 15 days to determine physical characteristics of the fruits. The parameters studied were

Fruit Set (%): Ten strands of each tree were selected for recording of abnormal and normal fruit set. Fruit set percentage was calculated by using following formula: (Total number of normal fruit set- Number of abnormal fruit set) × 100/ Total number of fruit

Weight of Fruit (gm): Ten fruits of each tree of date cultivars at each picking (at interval of 15 days) were weighed by electric balance and average weight of fruit of each cultivar was computed.

Fruit Length (mm): The length of ten fruits from each tree of date cultivars was measured with the help of vernier caliper and mean length per fruit was calculated. This practice was repeated at 15 days interval (each picking).

Pulp Weight (gm): The pulp/ flesh of ten fruits from each tree of date cultivars was weighed by electric balance and average weight of pulp per fruit was calculated at each picking.

Stone Weight (gm): Ten fruits from each tree of date cultivars at each picking were collected and stones were removed and reweighed by electric balance and average weight of stone of each cultivar was computed.

Fruit Yield Per Plant (kg): At maturity, the fruits collected from each picking were weighed and weight of each picking was added to calculate fruit yield per plant.

Statistical Analysis: Data collected for each parameter were statistically analyzed through analysis of variance technique after Steel et al., (1997) while the comparison of means was done by Duncan's Multiple Range Test (DMRT) using MSTATC computer program.

RESULTS AND DISCUSSION

Fruit Physical Characteristics

Fruit set (%age): The results indicate the date cultivars did not differ significantly with respect to percent fruit set as depicted in Figure 1. However, numerically the highest fruit set of 93.0% was recorded in Gulistan followed by Dhakki, Zaidi-1 and Khadrawi with fruit set of 92.05%, 89.0% and 86.0% respectively. The minimum fruit set of 78.0% was observed in Shakri. The variability of data in fruit set percentage was 8.845. These results are in agreement with the findings of Salemi *et al.* (2008). The difference in set fruit may be attributed to variation in agro-climatic conditions and the cultivars under study.

Fruit Weight (gm): The data relating to average weight of fruit of different cultivars at various picking dates is presented in Table 1. The perusal of data show that date cultivars differed significantly from each other with

respect to average weight of fruit. The significantly highest fruit weight of 11.20 gm was recorded in Dhakki that differed significantly from all other cultivars. It was followed by Gulistan, Shakri and khudrawi with average fruit weight of 8.029 gm, 6.113 gm and 5.885 gm respectively and all the three cultivars possessed statistically identical fruit weight. The fruits of cv Zaidi-1 possessed significantly the lowest fruit weight of 2.842 gm which differed significantly from all other cultivars.

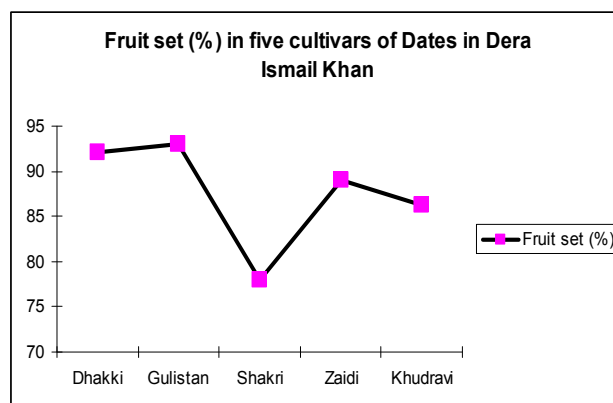


Figure: 1. Fruit set (%) in five different cultivars of Dates in Dera Ismail Khan.

The average weight of fruits varied significantly among different sampling dates. The significantly heaviest fruits (9.486 gm) were recorded on 20th July picking followed by 5th August and 5th July pickings with mean fruit weights of 9.456 gm and 8.698 gm respectively. However, the fruit weight at all the above three dates was statistically akin. The mean fruit weight of different cultivars picked on 5th May was lowest (1.565 gm) that differed significantly from all other sampling dates. Similarly the average fruit weight of 20th May, 5th June and 20th June sampling dates were statistically at par. During different sample collection dates, the mean fruit of Dhakki varied from 1.507 to 16.803gm while Gulistan 1.818-11.521gm, Shakri 1.009 to 8.233gm, Zaidi-1 1.110-3.508gm and Khudrawi 2.381 to 7.374gm.

The interaction effect of cultivars and sampling dates was also significant. The significantly maximum average fruit of 16.803 gm was registered in cv Dhakki at 20th July sampling. It was succeeded by Dhakki fruits picked on 5th August and both combinations were statistically at par. Almost 12.85% variability in data was noticed. The data suggests that average fruit weight of different cultivar increased progressively with the passage of time and it reached at maximum on 20th July then declined. Our results are in agreement with the findings of previous scientists. A great variation in average fruit weight has been reported by several workers (Chandra and Chaudhary, 1996; Elahmer *et al.*, 2007;

Mertia, 2010). Likewise, Al-Qureshi (2010) revealed that fruit weight of date cultivar Helani gradually increased during development until week 17 (Bisir stage) from

pollination then slightly decreased during ripening at week 23 (Rutab stage), but sharply decreased during the Tamer stage at week 27.

Table 1. Average Fruit Weight of Different Date cultivars during different sampling dates.

Cultivars	Dhakki	Gulistan	Shakri	Zaidi-1	Khudrawi	D/ Sampling Mean
5 th May	1.507 ^d	1.818 ^d	1.009 ^d	1.110 ^d	2.381 ^d	1.565 ^b
20 th May	5.211 ^{cd}	5.251 ^{abcd}	4.113 ^d	2.490 ^d	5.592 ^{abcd}	4.531 ^{ab}
5 th Jun	10.930 ^{abcd}	7.460 ^{abcd}	5.541 ^{abcd}	2.855 ^d	5.397 ^{abcd}	6.436 ^{ab}
20 th Jun	11.580 ^{abcd}	9.881 ^{abcd}	7.259 ^{abcd}	3.101 ^d	6.294 ^{abcd}	7.523 ^{ab}
5 th July	15.730 ^{abc}	10.89 ^{abcd}	8.094 ^{abcd}	3.273 ^d	7.517 ^{abcd}	8.698 ^a
20 th July	16.800 ^a	11.52 ^{abcd}	8.539 ^{abcd}	3.561 ^d	7.638 ^{abcd}	9.486 ^a
5 th August	16.640 ^{ab}	11.52 ^{abcd}	8.233 ^{abcd}	3.508 ^d	7.374 ^{abcd}	9.456 ^a
Cultivar Mean	11.200 ^a	8.029 ^b	6.113 ^b	2.842 ^c	5.885 ^b	

Means followed by same letter(s) do not differ significantly at 0.05 probability level

LSD at P_{0.05} for Cultivars = 2.690

LSD at P_{0.05} for D/Sampling = 6.053

LSD at P_{0.05} for C x D = 11.42

Fruit Length (mm): The data concerning fruit length as affected by periodic fruit development and cultivars is elaborated in Table 2. Significant variation existed among the cultivars with respect to fruit length. It varied from 18.77 to 35.87 mm. The significantly longest fruits were found in cv Dhakki (35.87 mm) followed by Gulistan with fruit length of 35.60 mm. Both cultivars were statistically similar but differed significantly from all other cultivars. The fruits of Khudrawi occupied third position in fruit length (30.90 mm). The significantly shortest fruits were recorded in cv Zaid-1 with 18.77 mm long fruits which differed significantly amongst the cultivars under trial. Shakri fruits possessed the intermediate fruit length of 29.12 mm. The perusal of Table 3 illustrates that fruit length of different cultivars differed significantly when picked at different dates during periodic development. Amongst sampling dates the lowest mean fruit length of 14.040 mm was observed on 5th May picking which differed statistically from other sampling dates. The mean maximum fruit length of 36.267 mm was noticed on 20th July picking that differed significantly from all other sampling dates except 5th August (36.107 mm). The length of fruit increased during periodic development until it attained its maximum on 20th July and then it remained constant or decreased. During fruit development the length of fruit of cv Dhakki varied from 14.13 to 45.43 mm while Gulistan, Shakri, Zaidi-1 and Khudrawi varied from 16.27-42.40 mm, 12.20-35.50 mm, 10.7-21.63 mm and 16.87-36.37 mm respectively.

The cumulative effect of cultivars and sampling dates on fruit length was also significant. The significantly maximum fruit length of 45.43 mm was recorded in cv Dhakki on 20th July and 5th August pickings. It was followed by 43.93 mm long fruit of 5th July sampling of cv Dhakki. However, all the three combinations were statistically at par. The significantly

lowest fruit length of 10.73 mm was registered on 5th May picking of cv. Zaidi-1. The variability in data was 8.09%. Mertia *et al.* (2010) have reported similar results regarding the length of fruit in different date cultivars. However, Ramdevputra *et al.* (2009) reported higher values for fruit length. The difference may due to variation in cultivars under investigation and the agro-climatic conditions of the study areas. Similarly Al-Qureshi (2010) reported that fruit length of date cultivar Helani gradually increased during development until week 17 (Bisir stage) from pollination then slightly decreased during ripening at week 23 (Rutab stage), but sharply decreased during the Tamer stage at week 27.

Pulp Weight (gm): The data concerning average weight of pulp/ fruit as affected by different cultivars and date of sampling is reported in Table 3. The pulp is the edible portion of fruit and has significance in the quality of fruit. The results show that cultivars varied significantly from each other with regard to pulp weight/ fruit. The highest mean pulp weight of 10.47 gm was registered in cv Dhakki which differed significantly from all other cultivars. It was succeeded by cv Gulistan with 7.202 gm mean pulp weight per fruit. The statistically lowest mean pulp weight/ fruit (2.292 gm) was recorded in Zaidi-1 fruits that differed significantly from all other cultivars. The mean pulp weight per fruit of cv Shakri (5.311 gm) and Khudrawi (5.055 gm) was statistically similar. Mean pulp weight was significantly different in different sampling dates. The significantly highest mean pulp weight fruit of 8.444 gm was noticed during 20th July sampling followed by 5th August and 5th July picking with average pulp weigh/ fruit of 8.261 gm and 7.668 gm respectively. However, all the three sampling dates were statistically at par. Likewise, the mean pulp weight recorded on 20th June (6.546 gm) and 5th June (5.776 gm) was also statistically similar. The significantly lowest mean pulp weight/ fruit of 1.542 gm was found during 5th

May sampling which differed statistically from all other sampling dates. The weight of pulp/fruit noticed on 20th May was 4.229 gm. The results suggest that pulp weight increased during periodic development of fruits in all the cultivars. The average pulp weight of cv Dhakki fruits increased from 1.494 gm to 15.78 gm with the periodic development of fruit. Similarly the mean pulp weight/ fruit of cv Gulistan increased from 1.787 gm to 10.36 gm. The pulp weight of Shakri, Zaidi-1 and Khudrawi progressed from 1.001-7.410 gm, 1.102-2.689 gm and 2.326-6.708 gm respectively. The interaction of cultivars and date of sampling significantly affected mean pulp weight/ fruit. The significantly maximum mean pulp weight/ fruit was recorded in Dhakki fruits collected on 5th August, It was followed by 15.66 gm and 14.58 gm pulp weight/ fruit reported in Dhakki collected on 20th July and 5th July. However, all the three combinations

were statistically alike. The statistically minimum pulp weight of 1.001 gm was recorded in Shakri fruits sampled on 5th May but it was statistically at par with pulp weight of Zaidi-1 fruits collected on 5th May. The standard deviation of data was computed as 14.66%. Iqbal *et al.* (2008) reported maximum pulp weight of 17.73 gm per fruit when pollinated by different male pollens. However, the maximum pulp weight of 2.689, 6.708, 7.400, 10.360 and 15.780 gm was found in Zaidi-1, Khudrawi, Shakri, Gulistan and Dhakki cultivars in this study. Al-Qureshi (2010) studied the physical and biochemical changes in 'Helali' date palm fruit during development and ripening in two successive seasons. They reported that fruit flesh weight gradually increased during development until week 17 (Bisir stage) from pollination then slightly decreased during ripening at week 23 (Rutab stage), but sharply decreased during the Tamer stage at week 27.

Table 2. Periodic Development of Fruit Length (mm) of Different Cultivars of date

Cultivars	Dhakki	Gulistan	Shakri	Zaidi-1	Khudrawi	D/ Sampling Mean
5 th May	14.13 ^q	16.27 ^p	12.20 ^{qr}	10.73 ^r	16.87 ^p	14.040 ^f
20 th May	24.53 ^l	27.80 ^k	23.03 ^{lm}	16.57 ^p	29.27 ^{jk}	24.240 ^e
5 th Jun	37.77 ^c	37.47 ^{ef}	30.23 ^j	19.40 ^o	29.40 ^{jk}	30.853 ^d
20 th Jun	39.87 ^d	41.90 ^{bcd}	32.73 ⁱ	20.63 ^{no}	33.90 ^{hi}	33.807 ^c
5 th July	43.93 ^{ab}	41.13 ^{cd}	35.07 ^{gh}	20.90 ^{no}	34.20 ^{hi}	35.047 ^b
20 th July	45.43 ^a	42.40 ^{bc}	35.50 ^{fgh}	21.63 ^{mn}	36.37 ^{efg}	36.267 ^a
5 th August	45.43 ^a	42.20 ^{bc}	35.10 ^{gh}	21.50 ^{mn}	36.30 ^{efg}	36.107 ^a
Cultivar Mean	35.87 ^a	35.60 ^a	29.12 ^c	18.77 ^d	30.90 ^b	

Means followed by same letter(s) do not differ significantly at 0.05 probability level

LSD at P0.05 for Cultivars = 0.6503

LSD at P0.05 for D/Sampling = 0.1652

LSD at P0.05 for C x D = 2.073

Table 3. Mean pulp weight/ fruits (gm) recording during periodic Development of fruits of different cultivars of Date

Cultivars	Dhakki	Gulistan	Shakri	Zaidi-1	Khudrawi	D/ Sampling Mean
5 th May	1.494 ^{no}	1.787 ^{no}	1.001 ^o	1.102 ^o	2.326 ^{mno}	1.542 ^d
20 th May	5.093 ^{kl}	4.804 ^{kl}	3.621 ^{lm}	2.486 ^{mno}	5.143 ^{jk}	4.229 ^c
5 th Jun	10.20 ^{bc}	6.638 ^{ghij}	4.939 ^{kl}	2.351 ^{mno}	4.750 ^{kl}	5.776 ^b
20 th Jun	10.50 ^b	8.298 ^{def}	6.164 ^{gk}	2.370 ^{mno}	5.401 ^{ijk}	6.546 ^b
5 th July	14.58 ^a	8.779 ^{cde}	6.944 ^{fgh}	2.419 ^{mno}	5.614 ^{hijk}	7.668 ^a
20 th July	15.66 ^a	9.753 ^{bcd}	7.410 ^{efg}	2.689 ^{mn}	6.708 ^{ghi}	8.444 ^a
5 th August	15.78 ^a	10.36 ^b	7.100 ^{fgh}	2.626 ^{mn}	5.444 ^{ijk}	8.261 ^a
Cultivar Mean	10.47 ^a	7.202 ^b	5.311 ^c	2.292 ^d	5.055 ^c	

Means followed by same letter(s) do not differ significantly at 0.05 probability level

LSD at P0.05 for Cultivars = 1.005

LSD at P0.05 for D/Sampling = 0.7947

LSD at P0.05 for C x D = 1.499.

Stone Weight (gm): Data concerning average weight of stone of different date cultivars at various sampling dates is presented in Table 4. The data show that date cultivars differed significantly from each other with respect to average weight of stone. The significantly highest stone weight of 0.8281 gm was recorded in Gulistan that differed significantly from all other cultivars. It was

followed by Dhakki and Shakri with average stone weight of 0.7728 gm and 0.7632 gm respectively and both cultivars possessed statistically similar stone weight. The fruits of cv Zaidi-1 possessed significantly the lowest stone weight of 0.5602 gm which differed significantly from all other cultivars. The average stone weight of fruits varied significantly among different sampling

dates. The significantly heaviest stones (1.062 gm) were recorded on 5th August sampling date followed by 20th July and 5th July pickings with mean stone fruit weights of 1.042 gm and 1.032 gm respectively. However, the stone weight at all the three dates was statistically at par. The mean stone weight of different cultivars picked on 5th May was the lowest (0.022 gm) that differed significantly from all other sampling dates. During different sample collection dates, the mean stone weight of Dhakki varied from 0.013 to 1.198 gm while Gulistan 0.030-1.165 gm, Shakri 0.008-1.133 gm, Zaidi-1 0.007-0.881 gm and Khudrawi 0.055-0.930 gm.

The interactive effect of cultivars and sampling dates was also significant. The significantly maximum

average stone weight of 1.198 gm was found in cv Dhakki at 5th August sampling. It was followed by stone of Gulistan fruits picked on 5th August. The statistically minimum stone weight of 0.007 gm was recorded in Zaidi-1 fruits collected on 5th May. The relative standard deviation of data was 7.71%. Similar results were found by Shamsi and Mazlounzadeh (2009) whom reported greater seed weight in date cultivars. The variation in results may be due to difference and cultivars and soil and agro-climatic conditions of the area. Likewise, Al-Qureshi (2010) noticed that seed weight of date cultivar Helani gradually increased during development until week 17, but decreased during the Tamer stages at week 23 and 27 from pollination.

Table 4. Average stone weight (gm) of different Date cultivars during different sampling dates.

Cultivars	Dhakki	Gulistan	Shakri	Zaidi-1	Khudrawi	D/ Sampling Mean
5 th May	0.013 ^k	0.030 ^{jk}	0.008 ^k	0.007 ^k	0.055 ^{jk}	0.022 ^c
20 th May	0.117 ^j	0.444 ^h	0.224 ⁱ	0.070 ^{jk}	0.449 ^h	0.261 ^d
5 th Jun	0.721 ^f	0.822 ^{de}	0.602 ^g	0.504 ^h	0.647 ^{fg}	0.659 ^c
20 th Jun	1.084 ^b	1.081 ^b	1.095 ^b	0.731 ^{ef}	0.893 ^{cd}	0.976 ^b
5 th July	1.135 ^{ab}	1.117 ^{ab}	1.151 ^{ab}	0.854 ^{cd}	0.901 ^{cd}	1.032 ^a
20 th July	1.141 ^{ab}	1.137 ^{ab}	1.129 ^{ab}	0.872 ^{cd}	0.929 ^c	1.042 ^a
5 th August	1.198 ^a	1.165 ^{ab}	1.133 ^{ab}	0.881 ^{cd}	0.930 ^c	1.062 ^a
Cultivar Mean	0.773 ^b	0.828 ^a	0.763 ^b	0.560 ^d	0.686 ^c	

Means followed by same letter(s) do not differ significantly at 0.05 probability level

LSD at P0.05 for Cultivars = 0.054

LSD at P0.05 for D/Sampling = 0.048

LSD at P0.05 for C x D = 0.092

Fruit Yield (kg/ tree): Figure 2 depicts the fruit yield per plant of different cultivars of date palm. The perusal of data indicates that date cultivars differed significantly with respect to fruit yield per plant. The significantly highest mean fruit yield/ tree of 97.59 kg was observed in cv Dhakki that differed statistically from all other cultivars. It was followed by cv Gulistan with fruit yield of 86.75 kg/ tree which ranked second among cultivars under investigation. The fruit yields achieved from cv Zaidi-1 (62.25 kg/ tree) and Khudrawi (62.00 kg/ tree) were statistically similar. The lowest yielder among the cultivars under test was Shakri which fetched 57.80 kg fruit per tree and differed significantly from all other cultivars. The relative standard deviation computed for data was 9.61%. The difference in average fruit yield per plant has been reported by various workers. These results point out that returns from date trees were encouraging signals for growers. Our results are in agreement with the findings of Sarfaraz *et al.*, (2006) who worked out yield and economics of growing date palm in Punjab. Similar results were reported by Shamsi and Mazlounzadeh (2009), Ramdevputra *et al.* (2009), Elhoumaizi *et al.* (2002), Al-Obeed *et al.* (2002), Al-Qurainy *et al.* (2002) and Mertia *et al.* (2010). This variation in fruit yield may be attributed to difference in cultivars under

investigation, soil and agro-climatic conditions and cultural practices adopted in the study areas.

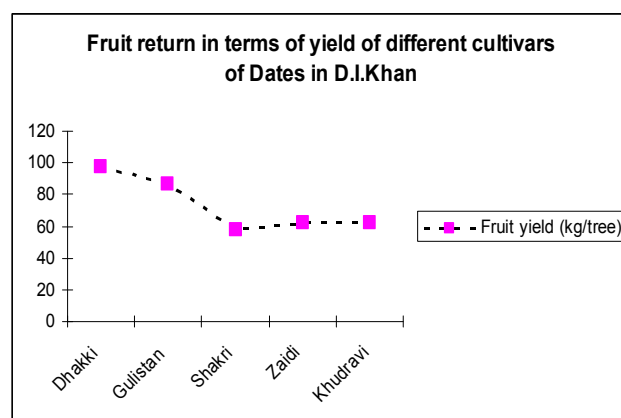


Figure 2: Fruit return in term of yield of different cultivars of dates in D. I. Khan.

Conclusion: Amongst cultivars Dhakki ranked first for possessing better fruit size and high yield, followed by Gulistan and Khudrawi. Hence, the study arrived at conclusion that date palm farmers would earn huge profit in view of its economical yield if date trees are planned on commercial basis.

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