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The Past and Present Day of Kiwifruit (*Actinidia deliciosa* Planch.) Breeding in Pazar Watershed, Turkey

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Abstract: In this study, the problems of kiwifruit breeding in Pazar watershed which is 37 km east of city of Rize were investigated with public survey and the results of public survey were presented in two periods (1996-2002, 2002-2006). According to the results of questionnaire of the year 2002; 57.7% of total kiwifruit producers started to establish kiwifruit garden to gain additional income and 62.02% of total kiwifruit gardens were established less than 1000 m² area, 24.05% of total kiwifruit producers did not do any search about kiwifruit breeding, while 38.8% of total farmers met serious problems while planting and caring of kiwifruit seedling, harvesting and marketing were serious problems. During the second period (2002-2006) the numbers of kiwifruit producers who wanted to gain additional income increased 5.26 percentage and in this period 66.66% of total kiwifruit gardens were established less than 1000 m² area and they and 81.48% of total kiwi farmers obtained kiwifruit seedlings from public bazaar and 55.55% of total kiwifruit farmers did not do any kind of site preparation before they planted kiwifruit seedlings. Agricultural activities are still being practiced because most people are socially and economically dependent on such activities in the area.

Key words: *Actinidia deliciosa*, kiwifruit breeding problems, pH, soil texture

INTRODUCTION

The kiwifruit is native to Southeast Asia. There are more than 50 species in the genus *Actinidia* and many have commercial potential (Strik, 2005). The plants need a long growing season (at least 240 frost-free days) which will not be hampered by late winter or early autumn freezes. When fully dormant they can withstand temperatures to about -15°C (Samancı, 1990; Eynard *et al.*, 1992; Strik, 2005). However they must acclimate to cold slowly and any sudden plunge in temperature may cause trunk splitting and subsequent damage to the vine. Late winter freezing temperatures will kill any exposed buds which limits the adaptable growing areas of kiwifruit. In the study area the kiwifruit is an appropriate crop wherever citrus fruits and fruit of grapevine are successful. Kiwifruit prefers somewhat acid (pH 5-6.5), well-drained soils that are rich in organic matter. The leaves may show nitrogen deficiency if the soil is too basic. The plants do not tolerate salty soils. Kiwifruit plants need large volumes of water during the entire growing season but must also be in well-drained soils (Morton, 1987; Strik, 2005). Watering regularly in the heat of the summer is a must. Never allow a plant to undergo

drought stress. Plants are heavy nitrogen feeders which should be applied in abundance during the first half of the growing season. Late season applications of nitrogen will enhance fruit size but are discouraged as the fruit then tends to store poorly. Even though land suitability for agricultural use is very limited in Pazar area. Agricultural activities are still being practiced because most people are socially and economically dependent on such activities in the area (Yüksek *et al.*, 2004). Total land area classified as available for agriculture is about 1,033 ha, but approximately 300 ha of this is used as settlement areas while 725 ha is used for the tea plantation and 8 ha is used for corn cultivations cover the rest.

Total land coverage in Pazar is about 34,732 ha and only 2.97% is suitable for cultivation (Yüksek, 2001; Yüksek and Yüksek, 2003). However, 25.40% (8,820 ha) of the total coverage is used for agricultural activities (Anonymous, 1993; Yüksek, 2001). Living conditions in the study area are getting difficult and the value of agricultural products is grown in the area decreasing from day to day (Yüksek and Yüksek, 2004). For this reason, farmers have been started to test new agricultural products and kiwifruit is one of them. However, during the trials of new agricultural product many of the farmers have faced a lot of problems (Such as kiwifruit breeding, seedling supply, soil preparation, irrigation, harvesting,

etc...). The objectives of this study were to: (i) determine the problems of establishing kiwifruit vineyard and (ii) discuss the reasons of the problems.

MATERIALS AND METHODS

Site description: The study was conducted in Pazar watershed which is located on the Blacksea coast of northern Turkey. It is between 40°52' N latitude and 40°46' longitude (Fig. 1). Mean annual temperature is 14°C with and mean annual precipitation of 1953 mm. The climate is very humid with short cold winters (Yüksek 2001). During the vegetation period (from March 15 th to November 2 nd) mean monthly temperature is 16.22°C and mean montly percipitation is 157 mm (Yüksek, 2001).

Field methods: The main material of this study is kiwifruit gardens in Pazar watershed. For this purpose, study area were explored North to South and East to West and the location of kivifruit gardens were determined

(Fig. 2A and B). After then, questionnarie which are consist of location and size of garden, origin of seedling, site preparation, planting, harvesting and marketing were applied to kiwifruit producer face to face method in 2002 and 2006 (Arsam, 2005). Top soil samples were taken from 0-20 cm depth in order to determine soil texture, pH and organic matter (Crepin and Johnson, 1993).

Laboratory analysis: Particle size distribution was determined on the total soil sample basis, including coarse fragments (>2 mm) and on soil size material (<2 mm) alone. Percentages of soil particles >2 mm and <2 mm were determined by sieving and weighing. Sand, silt and clay ratio in the <2 mm fraction were then determined using Bouyoucos hydrometer method (Sheldrick and Wang, 1993; Yüksek, 2001). Soil organic matter was determined in Walkey-Black procedure. Soil pH was determined in a 1:1 2/5 soil water mixture using orion 420 A pH meter (Gülçür, 1972; Yüksek, 2001).

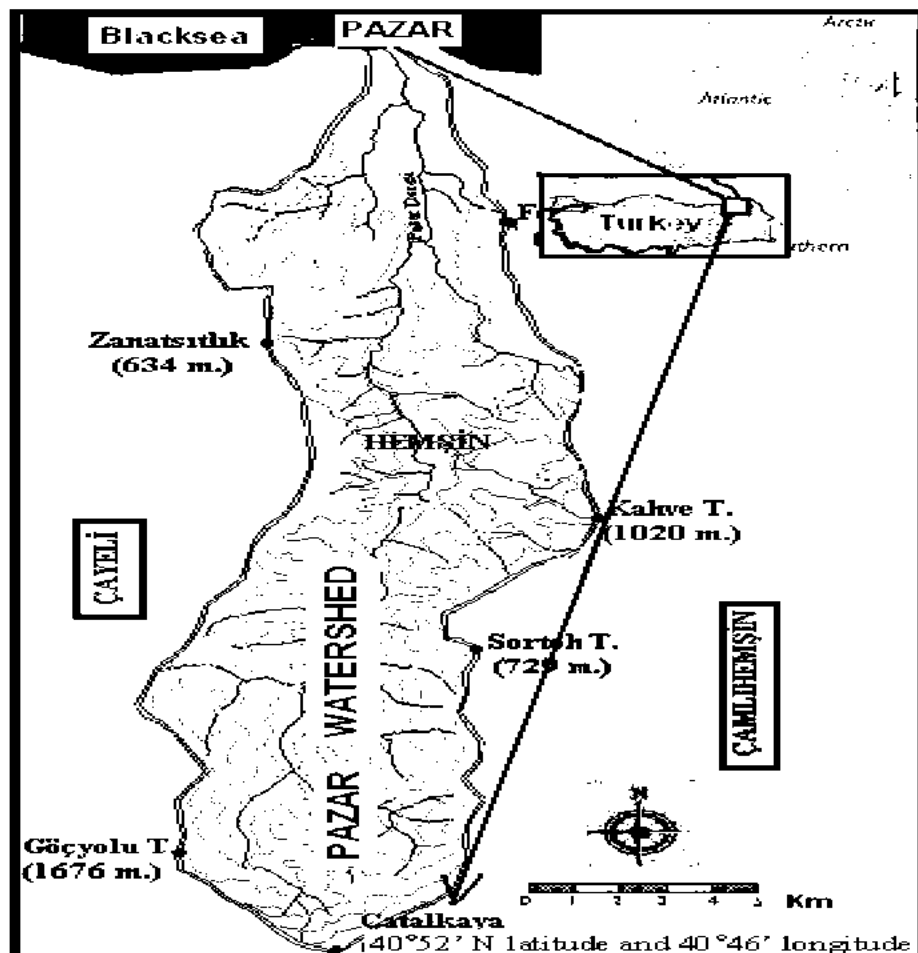


Fig. 1: Location of the study area, Pazar Watershed in Rize, Turkey



Fig. 2: Kiwifruit gardens within tea cultivation in the study area

RESULTS AND DISCUSSION

The main reason why producers start to breeding kiwifruit is to gain additional income and the other reason is curiosity. In first period, 57.7% of producer start to grown kiwifruit to gain additional income. And the ratio have been increased 62.96% in second period (Table 1).

First kiwifruit garden was established in 1995 and the numbers of gardens were increased from the year 1995 to 2002. During the second period, the marketing price of kiwifruit was increased the highest level of the past years. For this reason, other farmers, who has not kiwifruit gardens, started to establish new kiwifruit gardens (Table 2). Approximately 62.02% of kiwifruit gardens were established less then 1000 m², 17.70% of total kiwifruit gardens were established between 1000-2000 m² and 20.26% of total kiwifruit gardens were established more then 2000 m² area (Table 3). During the first period 86.5% of kiwifruit gardens were established within tea cultivation areas, but in the second period this rate decreased 27.25%.

While kiwifruit gardens which were established within crop cultivation were 13.5% in the first period, it was increased in the second period and reached 40.75% of total kiwifruit gardens (Table 4).

None of the kiwifruit producers did not do any good research about kiwifruit breeding. Of 53.2% of total kiwifruit producers given oral informations about kiwifruit breeding from other farmers who breed kiwifruit. Of 8.86% of total kiwifruit producers read some non-scientific information about kiwifruit breeding and 24.05% of total kiwifruit producers did not do any survey about kiwifruit

Table 1: Distribution of the reason why farmers start to kiwifruit in the study area

| Section of questionnaire (Public survey) | First period (1996-2000) | | Second period (2000-2005) | |
|--|--------------------------|----------|---------------------------|----------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| To gain additional income | 30 | 57.7 | 17 | 62.96 |
| Curiosity | 19 | 36.5 | 6 | 22.22 |
| Other (Such as.....) | 3 | 5.8 | 4 | 14.82 |
| Total | 52 | 100.0 | 27 | 100.00 |

Table 2: Distribution the numbers of kiwifruit producers according to years

| Years | No. of producer | Rate (%) | Years | No. of producer | Rate (%) |
|-------|-----------------|----------|-------|-----------------|----------|
| 2005 | 9 | 11.39 | 2001 | 11 | 13.92 |
| 2004 | 8 | 10.12 | 2000 | 8 | 10.13 |
| 2003 | 10 | 12.65 | <1999 | 7 | 8.88 |
| 2002 | 26 | 32.91 | Total | 79 | 100.00 |

Table 3: Distribution of the size of kiwifruit gardens between 1996-2005

| Size of kiwifruit gardens (m ²) | First period (1996-2000) | | Second period (2000-2005) | |
|---|--------------------------|----------|---------------------------|----------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| <1000 | 31 | 59.6 | 18 | 66.66 |
| 1001-2000 | 11 | 21.2 | 5 | 18.51 |
| 2001> | 10 | 19.2 | 4 | 14.83 |
| Total | 52 | 100.0 | 27 | 100.00 |

Table 4: Past and current land use type of kiwifruit gardens

| Kiwifruit gardens | First period (1996-2000) | | Second period (2000-2005) | |
|--|--------------------------|----------|---------------------------|----------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| Tea cultivation | 45 | 86.5 | 16 | 59.25 |
| Other cultivation | 7 | 13.5 | 11 | 40.75 |
| Types (bean, potatoes, maize, black raspberry and cabbage) | | | | |
| Total | 52 | 100.0 | 27 | 100.00 |

Table 5: Rational distribution of the studies about kiwifruit breeding that was done by farmers

| Type of research | First period (1996-2000) | | Second period (2000-2005) | |
|--|-----------------------------|-------------|------------------------------|-------------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| Talked with other producers (a) | 28 | 53.8 | 14 | 51.85 |
| Read some papers about kiwifruit breeding (b) | 4 | 7.7 | 3 | 11.11 |
| Both (a and b) | 10 | 19.2 | 1 | 3.70 |
| No survey | 10 | 19.3 | 9 | 33.34 |
| Total | 52 | 100.0 | 27 | 100.00 |

Table 6: Rational distribution of the origin of kiwifruit seedlings

| Kiwifruit seedlings | First period (1996-2000) | | Second period (2000-2005) | |
|----------------------|-----------------------------|-------------|------------------------------|-------------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| People bazaar | 21 | 40.4 | 22 | 81.48 |
| Other producers | 27 | 51.9 | - | - |
| Certificated sellers | 4 | 7.7 | 5 | 18.52 |
| Total | 52 | 100.0 | 27 | 100.00 |

breeding (Table 5). Ex-land use type is very important to establish kiwifruit gardens cause kiwifruit are susceptible to verticillium wilt and should avoid planting in soil with a history of strawberry, black raspberry, potatoes or other crops in solonaceae family. There wasnt any close kiwifruit nursery in the study area in 1996. For this reason first kiwifruit producers obtained kiwifruit seedlings which origin was unknown from people at bazaar (Table 6).

Other producers propagated kiwi plants by cuttings from the seedling taken from people bazaar, therefore the origin many of kiwifruit seedlings have been unknown. Only 11.79% of total kiwifruit producers used certificated kiwifruit seedlings during establishing kiwifruit gardens. Rational distribution of the origin of kiwifruit seedlings presented in Table 6.

The owners' of the kiwifruit farmers age are over the 45 and they are not well educated. Illiteracy of farmers and Lack of plan cause to a lot of problems of kiwifruit breeding. Then, to establish high quality kiwifruit vineyard, farmers should do some study about their soil properties, climate and desire of cultivation ambience in the study area. Government should prepare agro-ecological land use plan as soon as possible to help farmers to solve these problems.

The annual living income of farmers have been decreasing from year to year (annual income per family with 4 people in the study area is between 2500-3500 \$). The cheapest kiwifruit seedlings can be obtained from the

Table 7: The number of kiwifruit producers who do site preparation before kiwifruit seedling planting

| Type of site preparation | First period (1996-2000) | | Second period (2000-2005) | |
|-----------------------------|-----------------------------|-------------|------------------------------|-------------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| Simple soil preparation | 41 | 78.8 | 12 | 44.45 |
| No soil preparation | 11 | 21.2 | 15 | 55.55 |
| Total | 52 | 100.0 | 27 | 100.00 |

Table 8: Rational distribution of the problems during kiwifruit breeding

| Problems in kiwifruit breeding | First period (1996-2000) | | Second period (2000-2005) | |
|-----------------------------------|-----------------------------|-------------|------------------------------|-------------|
| | No. of producer | Rate (%) | No. of producer | Rate (%) |
| Seedling obtaining | 23 | 27.1 | 4 | 14.81 |
| Planting of seedling | 21 | 24.7 | 3 | 11.11 |
| Caring of seedlings | 33 | 38.8 | 6 | 22.24 |
| Harvesting | 5 | 5.9 | 7 | 25.92 |
| Marketing | 3 | 3.5 | 7 | 25.92 |
| Total | 52 | 100.0 | 27 | 100.00 |

public bazaar, therefore, farmers buy seedlings from the public bazaar. Because they can buy one seedlings 3-3.5 \$ from the public bazaar while they have to pay 13-16 \$ for one certificated seedlings. None of the kiwifruit producers have not got soil analyzed where they established kiwifruit gardens and there is not detailed soil survey about the study area. However, 67.09% of total kiwifruit producers did simple soil preparation before they planting kiwifruit seedlings (Table 7).

According to Table 8, caring of seedlings was the biggest problem during first period while harvesting and marketing the biggest problem during the second period. Table 8 shows that obtaining and planting of seedling problems decreased through the first period to second period. During the first period, it was difficult and expensive to find certificated kiwifruit seedlings for this reason early producers prefer uncertificated kiwifruit seedlings from public bazaars. Owing to decreasing of agricultural income from year to year farmers towards to public bazaar to find cheaper kiwifruit seedlings.

According to soil analysis; 15.10% of soils of kiwifruit garden has drainage problem while 96.20% of kiwifruit gardens has pH problems; 59.49% of kiwifruit gardens pH is changed between 5.0-5.5 while 24.05 and 40.51% of total kiwifruit garden has serious acidity problems in the study area. Top soils have not got enough soil organic matter in the study area. According to soil analysis 65.82% of top soils (0-20 cm depth) have less then 2% organic matter.

Table 9: Rational distribution of soil texture, pH and organic matter of kiwi fruit gardens

| Soil properties | First period (1996-2000) | | Second period (2000-2005) | |
|------------------------------|--------------------------------|-------------|--------------------------------|-------------|
| | No. of kiwifruit gardens | Rate (%) | No. of kiwifruit gardens | Rate (%) |
| Texture | | | | |
| SaCL | 34 | 65.38 | 13 | 48.14 |
| SaL | 12 | 23.07 | 6 | 22.22 |
| L | 6 | 11.55 | 8 | 29.64 |
| Total | 52 | 100 | 27 | 100 |
| pH (% H₂O) | | | | |
| 5.3-5.5 | 3 | 5.77 | - | - |
| 5.0-5.3 | 30 | 57.69 | 14 | 51.86 |
| 4.5-5.0 | 12 | 23.07 | 7 | 25.92 |
| 4.2-4.5 | 3 | 5.77 | 5 | 18.52 |
| 4.0-4.2 | 2 | 3.85 | 1 | 3.70 |
| 3.8-4.0 | 2 | 3.85 | -- | -- |
| Total | 52 | 100 | 27 | 100 |
| O.M (%) | | | | |
| 0.5-1.0 | 5 | 9.62 | 4 | 14.81 |
| 1.1-1.5 | 12 | 23.08 | 10 | 37.04 |
| 1.6-2.0 | 15 | 28.85 | 6 | 22.23 |
| 2.1-2.5 | 8 | 15.38 | 4 | 14.81 |
| 2.6-3.0 | 7 | 13.45 | 2 | 7.41 |
| > 3.0 | 5 | 9.62 | 1 | 3.70 |
| Total | 52 | 100 | 27 | 100 |

O.M: Organic Matter (%), SaCL: Sand Clay Loam, SaL: Sandy Loam, L: Loam

For these reasons, farmers meet some problems during the kiwifruit breeding. Detailed soil texture, pH and organic matter (O.M) presented in Table 9.

According to Yüksek and Yüksek (2003) 17.72% of soils of kiwifruit garden has drainage problem while 96.2% of kiwifruit gardens has pH problems; 63.46% of kiwifruit gardens pH is changed between 5.0-5.5 while 23.07% is between 4.5-5.0. 13.47% of total kiwifruit garden has serious acidity problems in the study area.

It was known that the optimum pH for kiwifruit (*Actinidia deliciosa* Planch) is between 5.5 and 6.0, vines show poor grow at pH above 7.2 and below 4.5 (Anonymous, 2002). Farmers randomly established kiwifruit gardens in their own land and cause of illiteracy and economic conditions they have not got their soils analyzed before they established gardens.

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