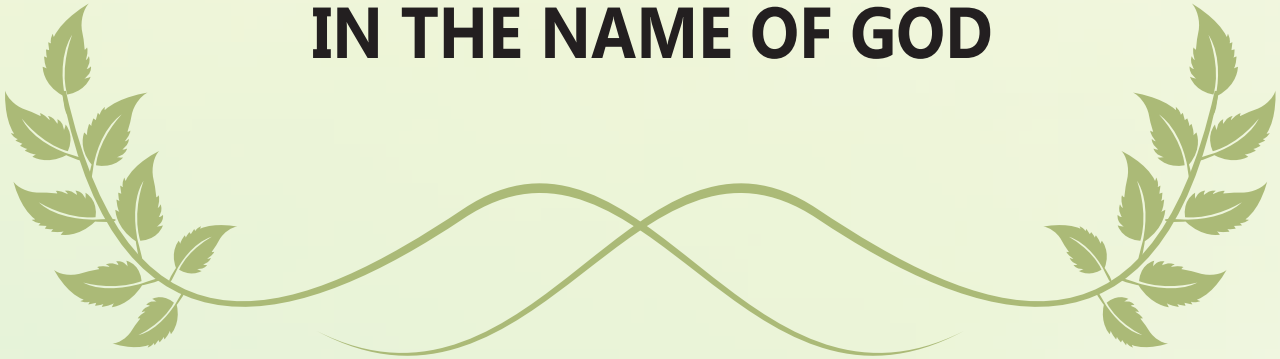
Ministry of Agriculture Jahad
Agricultural Research, Education &
Extension Organization
Horticultural Sciences Research Institute

# Horticultural Sciences Research Institute (HSRI)

KARAJ - IRAN, 2021

# IN THE NAME OF GOD



**This brochure is, about Horticultural Sciences Research Institute (HSRI), prepared and compiled by the "Office of International Affairs, Organizations and Specialized Centers" under the supervision of Dr. Shokrollah Hajivand,the director of HSRI.**

# Horticultural Sciences Research Institute (HSRI)

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# Director General's statement

With the growing population of the world, food supply is the main problem of human societies due to lack of water, land, other resources and global climate change has accompanied with many challenges.

The agricultural sector, particularly horticulture, plays an important role in providing healthy food, quality food, food security, improving nutrition and human health, economic development, job creation, and the development of small communities and villages.

Iran, with its individual and diverse climatic conditions, various areas under cultivation and production,

as well as quality of horticultural products is known as one of the most important horticultural regions in the world.

This climate diversity has led to the cultivation of a variety of horticultural products, including tropical and semi-tropical fruits, temperate zone fruits, nuts, vegetables, tea, flowers and ornamental plants in a wide range. In other words, horticultural products due to having a wide range of soil adaptation and tolerance of adverse conditions, high added value, job creation and their role in food security and health, the country's economy and the export of non-oil materials, have an extraordinary position among other agricultural products. Furthermore, horticultural products constitute 46% of the country's agricultural products.

One key strategy is the introduction of new and resistant cultivars, in order to produce horticultural products in barren lands, as a result of which the development of rural areas will follow.

HSRI's experts seek to take into account the climatic characteristics of the country and look at the global horizon in expanding the cultivation of modified horticultural products. This introduction of new high-capacity cultivars would be in line with global climate change.

# HSRI
## Horticultural Sciences Research Institute

Iran is undoubtedly regarded as one of the most important areas for the production of horticultural products. According to the FAO and domestic statistics, the cultivation and development of various horticultural-products have undergone an upward trend in recent decades. The presence of different climates and high level of cultivation of these products have led Iran to be among the top 10 countries in terms of horticultural products. With regard to horticultural potential, Iran can be one of the most important exporters of different horticultural products in the world.

This brochure spotlights the structure and the tasks of the Horticultural Sciences Research Institute (HSRI), including the main research activities, major achievements, and important future issues.

## The History

Horticultural Sciences Research Institute (HSRI) was established in 2015 from the consolidation and merger of some research institutes and departments aimed to further coordination between research sectors and optimal application of available research facilities and infrastructures. At present, HSRI comprises seven research centers, namely:

1) Pistachio Research Center (in Rafsanjan)
2) Tea Research Center (in Lahijan)
3) Date Palm and Tropical Fruits Research Center (in Ahwaz)
4) Vegetable Research Center (in Karaj)
5) Ornamental Plants Research Center (in Mahallat)
6) Citrus and Subtropical Fruits Research Center (in Ramsar)
7) Temperate Fruits Research Center (in Karaj)

This institute executes its research programs by nearly 216 researchers,17 dedicated research stations and 63 provincial research stations located in different area across the country.

The main goals of HSRI are summarized as follows:

1-Planning and development of research in the field of horticulture.

2-Improving horticultural production for target markets through demand driven research.

3-Introducing new horticultural cultivars.

HSRI's research activities are being conducted at the affiliated centers and have been organized into three research groups, including:

- Genetics and Plant Breeding
- Technology and Production Management
- Physiology and Post-harvest Technology

## The Missions

- Providing a suitable platform to conduct horticultural research projects.
- Cooperation with universities, educational and research institutes to improve the quality of research activities.
- Production and supply of primary source of virus free plants.
- Transferring knowledge and technology to private sectors and farmers.
- Application and extension of new research findings in crop production systems and among horticultural operators.

**We believe that research in the field of horticulture is one of the strong potentials for the development and growth of national technologies and a way to get productive prosperity, self-sufficiency and rapid economic growth.**

# Pistachio Research Center (PRC)

## The History

Pistachio cultivation in Iran was assessed to be more than 500,000 hectares in 2019. The cultivation of this product is distributed in 28 provinces of the country. Pistachio is one of the most important horticultural products in Iran and the main commercial product of the agricultural sector which alone accounts for one third of the total exports of this sector. Pistachio is one of the ten major non-oil exports of the country which was ranked seventh with 2.2% of total value of non-oil exports. The economic importance of pistachio as well as its adaptation

to different environmental conditions has made it to an outstanding product in areas that are not suitable for growing other crops.

Iran's Pistachio Research Institute (IPRI) started pistachio research activities with 6 research departments in Rafsanjan (the most important pistachio cultivation area in Kerman province) since 1993. With the establishment of the Horticultural Sciences Research Institute (HSRI) in 2015 in Karaj, it was renamed into Pistachio Research Center (PRC). The PRC has 26 scientific-board members working in Kerman and pistachio research stations in Semnan, Qazvin, Khorasan Razavi and Yazd provinces.

## Research Infrastructure

At present, more than 161 pistachio cultivars have been identified in terms of morphological traits and conserve in pistachio collections of Kerman, Semnan, Qazvin, khorasan Razavi and Yazd provinces.

The most important pistachio collections in Iran are:

- Pistachio collection of Naserieh station with 40 cultivars established in 1968.

- Pistachio collection of Kerman station with 29 cultivars established in 1972.
- Pistachio collection of Rafsanjan with 45 cultivars established in 1982.

Furthermore, since 1996 by collecting of local and commercial pistachio cultivars from different regions of Iran, new collections were established in pistachio research stations of Damghan, Qazvin, and Feizabad.

The PRC has more than 60 ha of experimental pistachio orchards in Rafsanjan, 15 ha in Damghan, 12 ha in Qazvin, 15 ha in Feizabad and 2 ha in Ardakan-Yazd. PRC also has 3 research greenhouses that are used as experimental media for research projects. This center has several laboratories engaged in genetics, plant breeding, pests and plant diseases, plant nutrition, aflatoxin and food science and technology as well as 6 research stations.

## Main Research Activities

Research activities of PRC are being carried out in three research groups

including Genetics and Plant Breeding, Technology and Production Management, Physiology and Post-harvest Technology.

Some of the most important ongoing projects in the last few years are as follows:

1. Comparison of UCB-1 (tissue culture and seedling) and Badami Zarand pistachio rootstocks to salinity stress based on growth indices and eco-physiological parameters under greenhouse conditions.
2. Identification of different salt-tolerant pistachio genotypes under salinity stress in Kerman orchards.
3. Identifying adaptable pistachio cultivars and genotypes to current climate changes (warm and temperature fluctuations) in Kerman province.
4. Hybridization between different species of pistachio genus to develop drought tolerant rootstocks using diallel mating scheme.
5. The effect of foliar amino acids on quantitative and qualitative characteristics of pistachio trees.
6. Comparison of two methods of top working in adult pistachio trees.
7. A technical and economical study on the role of Shade/Net houses in preventing

damage to environmental stresses on pistachio yields compared to open fields.

8. Investigation of different temperatures in different rootstocks to study the morphological, physiological and biochemical traits.
9. Management of Aspergillus and aflatoxin contamination in pistachio orchards.
10. Determination of water requirement of pistachio trees in traditional and modern irrigation systems.
11. Assessment of salinity, drought stresses and toxicity of specific elements on different pistachio rootstocks and cultivars.
12. Time and method of application of chemical fertilizers in different irrigation systems.
13. Investigation of the nutrient deficiency and nutritional disorders in pistachio trees.
14. Investigation of factors affecting pistachio total productivity.
15. Investigation of the aspects of damage from leaves/clusters fall and nut burns in pistachio orchards with presenting solutions to prevent or reduce it in future.
16. Investigating the effects of sulfur on quantitative, qualitative

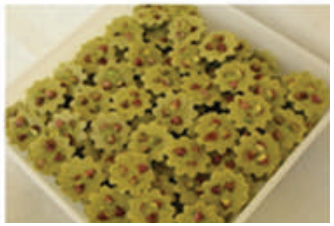
and health characteristics of pistachio fruit.

17. Increasing shelf life of fresh pistachio fruits using different methods, conditions and packages.
18. Optimizing phenolic compounds extraction from pistachio hulls.
19. The effect of ozone gas on the physicochemical, sensory, and aflatoxin characteristics of dried pistachios.
20. The investigation and applying effective and efficient research activities in pistachio product in the field of different varieties.

## Achievements

► Identification of an early flowering cultivar HR53 with low chilling requirements. This promising cultivar can reduce the damage caused by lack of chilling requirement in recent years with hot winter. HR53 can also be used in breeding programs to produce hybrids with low chilling requirements.

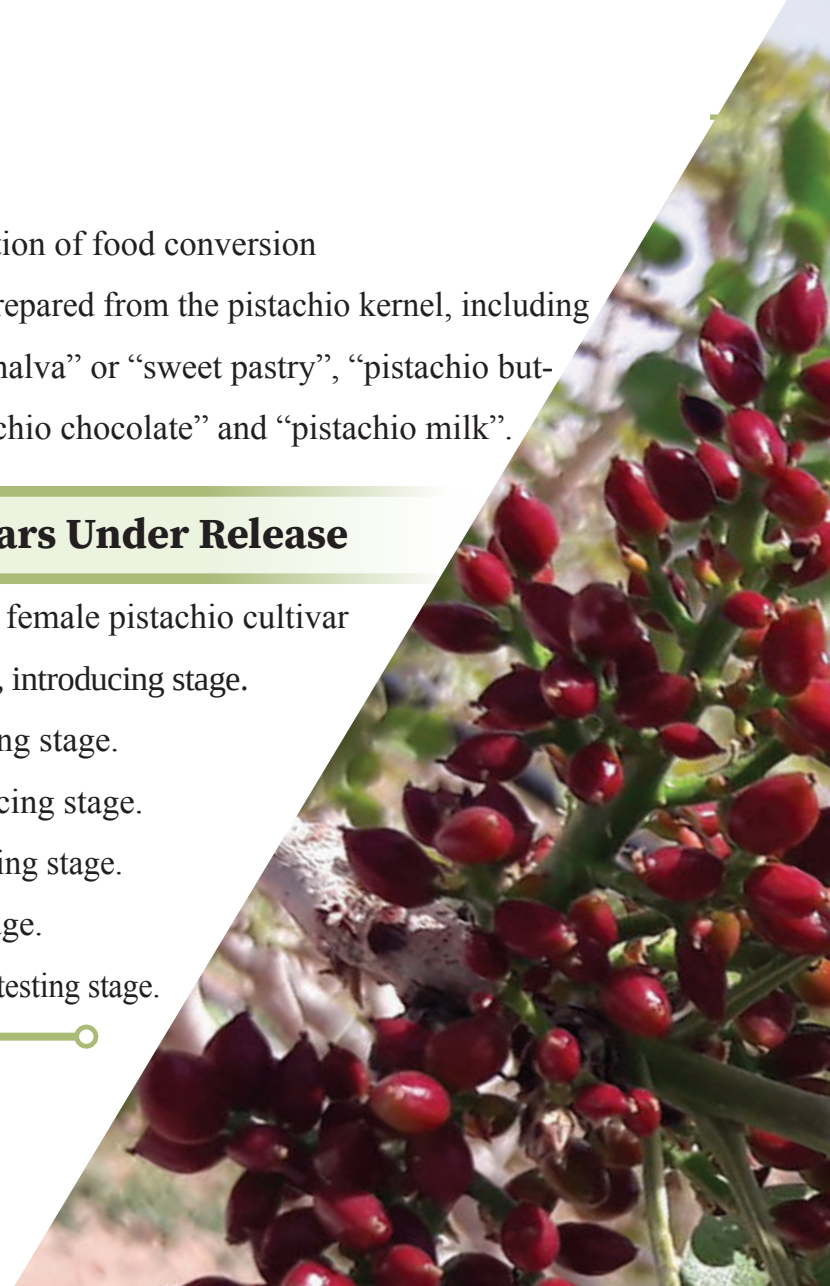
- Top pollinator genotypes suitable for commercial pistachio cultivars in Iran.
- The use of "Elite" fungicide to manage *Phytophthora* crown and root rot disease of pistachio.
- Installation of PVC pipes and implementation of drip irrigation system in pistachio gardens.



► Production of food conversion products prepared from the pistachio kernel, including “pistachio halva” or “sweet pastry”, “pistachio butter”, “pistachio chocolate” and “pistachio milk”.

## Cultivars Under Release

1. HR53 female pistachio cultivar (Rafsanjan), introducing stage.
2. A2346 female pistachio cultivar (Rafsanjan), introducing stage.
3. FAS1673 female pistachio cultivar (Feizabad), introducing stage.
4. BA-SH67 female pistachio cultivar (Damghan), introducing stage.
5. BS1 female pistachio cultivar (Saveh), DUS testing stage.
6. JS1 female pistachio cultivar as rootstock (Sarvestan), DUS testing stage.



# Tea Research Center (TRC)


## The History

North of Iran, including Guilan province and the west of Mazandaran, is the main cultivation area of tea with more than 28000 ha. Tea production plays a critical role in economic income of more than 50000 rural families. Based on 2019 official statistics, the overall production of tea green leaves was 28519 tones which led to the production of useable dry tea of 28519 tones.

Tea Research Center (TRC) was established under the title of Technical Office of Tea in 1984 as a sub-division of the Tea Organization of Iran. Since its inception, TRC has been the only national center in Iran to generate and disseminate new technologies related to tea cultivation and processing. The office was established to contribute to research activities and innovative projects to increase quantity and

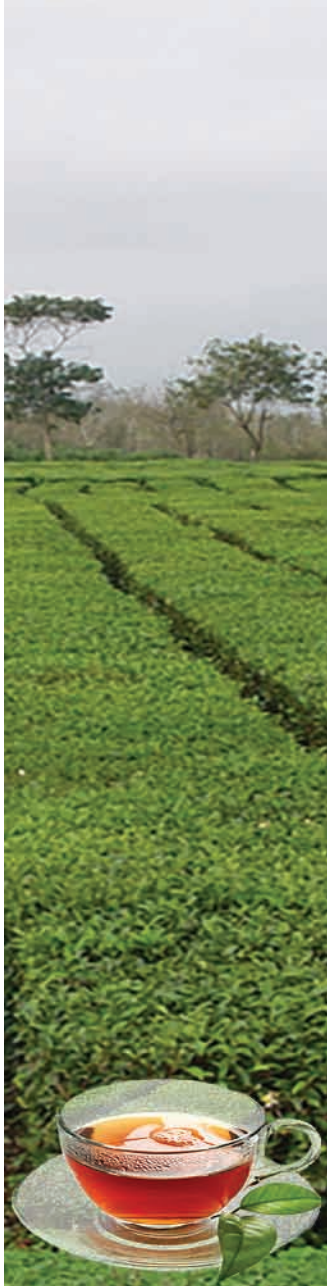
quality of the produced tea, the extension of breeding and cultural techniques and allocating loans with a long-term refund to develop rain irrigation systems and tea gardens. This reserch center has undergone several name changes over time; but in short, after the establishment of the Horticultural Sciences Research Institute (HSRI), its name was finally changed to Tea Research Center as one of the affiliated centers of HSRI.

Sixteen academic staffs and 8 researchers are currently employed in three research groups including Genetic and Plant Breeding, Technology and Production Management of Tea, Physiology and Post-harvest Technology.

## Research Infrastructure

Tea research stations include:

- Shahid Eftekhari (Guilan province, Shaft, Fashalam )
- Kashef (Guilan province, Siahkal, Ezbaram )
- Shahid Chamran (Mazandaran province, Tonekabon, Nashtaroud)



- Shohada-e- Rezvanshahr (Guilan province, Rezvanshahr, Sekam )
- Fajr (Guilan province, Lahijan)
- Shahid Motahhari (Guilan province, Langroud, Khalesar)
- Shohada -e- Ramsar (Mazandaran province Ramsar, Talarsar)

**Laboratories:**

1. Genetic and Breeding Lab
2. Tissue Culture Lab
3. Soil, Plant and Water Analysis Lab
4. Plant Protection Lab
5. Irrigation Lab
6. Chemistry Lab
7. Organoleptic Laboratory and Miniature Tea Processing Lab

## Main Research Activities

1. Applying different molecular and traditional breeding methods (Selection, Hybridization and Mutation).
2. Releasing new cultivars in order to achieve high yield, quality and tolerance to biotic and a biotic stresses.
3. Investigation, identification and conservation of tea germplasm.
4. Monitoring of soil fertility and fertilizer recommendation for tea genotypes.
5. Development of integrated management strategies to control major tea diseases and pests with a special preference to biological control.
6. Assessing of microwave application in green tea processing.
7. Tea processing and quality assessment of new clones.
8. Development of technologies to enhance made-tea quality.
9. Development of standards for tea.

▲*Camellia sinensis* cv. Kashef
High quality and yield

▼*Camellia sinensis* cv. Lahij
High quality and yield

## Achievements

1. Release of new clonal cultivars (Kashef and Lahij).
2. Achievement of three tea propagation methods including modified traditional cutting, tissue culture and hydroponic technique.
3. Achievement of the functional food production of tea.
4. Improving the quality of black tea by changing the tea manufacturing method.
5. Food color production from tea.
6. Preparation of soil fertility maps of Iranian tea gardens.
7. Preparation of distribution map for tea root lesion nematode in tea cultivation areas.
8. Introduction of some bio-control approaches against tea root lesion nematode.

9. Determination of life cycle, hibernate stages and the main environmental factors on population dynamic of tea root lesion nematode.
10. Optimization of water and manure consumption in rain-fed and irrigated gardens.
11. Bio-control approaches against tea mealy bug using *Cryptolaemus montrouzieri*.
12. Determination of the best irrigation program and management in the gardens equipped with irrigation system.
13. Using tea seed saponin against important tea pests.
14. Preliminary experiments in clone selection framework to obtain promising clones in Fouman, Shaft and Lahijan tea plantations.

## International Scientific Collaboration

Cooperation in conducting of three confirmed research projects in MOU between "Agricultural Research, Education and Extension Organization (AREEO)-Iran" and "Yunnan Academy of Agricultural Sciences (YAAS)-China":

1. Investigation of adaptation, growth properties and the main quality components of tea varieties imported from Yunnan province, China.
2. Feasibility study of conventional tea- making methods in Yunnan province of China on Iranian tea green leaves.
3. Study of methods used in Yunnan province to mitigation climate changes in tea plantations of Iran.

**Extraction of tea seed oil using solvent**

**Clooney tea cabinet production**

**Production of functional cookies with green tea**

**Extraction of saponin from tea seeds**


# Date Palm and Tropical Fruits Research Center (DPTFRC)

## The History

Research activities on date palm go back to 1950s. After undergoing several name changes during the time, since 2015 all research activities on date palm and tropical fruits have being carried out at Date Palm and Tropical Fruits Research Center (DPTFRC) under the supervision of Horticultural Sciences Research Institute (HSRI).

According to FAO statistics in 2018, Iran with production of 1.20 million tons of dates, ranked third in date production in the world after Egypt and Saudi Arabia. Moreover, Iran with the exports of 254 thousand tons and worth

of 250 million dollars was the first date exporter in the world. In 2018, banana, mango, ber, guava, sapodilla (chikoo), papaya, coconut and tamarind were the most important tropical fruits grown in Iran, respectively. In total, tropical fruits with 9517 ha of bearing cultivated area and production of 161.5 thousand tons of product, comprise 0.39% of the total bearing cultivated area and 0.79% of the total production of horticultural products in the country. Currently, 17 scientific staff members and 6 research experts are carrying out the research on dates and tropical fruits in DPTFRC and its research stations.

## Research Infrastructure

Date Palm and Tropical Fruits Research Center consists of three research groups of Genetic and Plant Breeding, Technology and Production Management, Physiology and Post-harvest Technology. The date palm and tropical fruits research stations located in the main provinces of their production are listed as follows:

- Ahwaz station (in Khouzestan province)
- Ommoltomair station (in Khouzestan province)
- Ab Pakhsh station (in Boushehr province)
- Jahrom station (in Fars province)

- Minab station (in Hormozgan province)
- Haji Abad station (in Hormozgan province)
- Aziz Abad of Bam station (in Kerman province)
- Jiroft (in Kerman province)
- IranShahr station (in Sistan and Balouchestan province)
- Chabahaar station (in Sistan and Balouchestan province)
- Zabol station (in Sistan and Balouchestan province)

Around 300 cultivars of the most important date cultivars have been stored in nine collections across the country.

**The laboratory complex includes five laboratory units as follows:**

- Breeding laboratory
- Plant pest laboratory
- Plant diseases laboratory

Date's packaging pilot plant is considered as one of the practical solutions to create a national pattern system in order to promote scientific, hygienic and standard methods of date production. This manufacture was constructed in accordance with the standards and with the aim of implementing the HACCP system in an area of 300 square meters of production hall and 200 square meters of warehouse.

## Main Research Activities

So far, more than 228 research projects in the field of various challenges of date palm and tropical fruits have been done by DPTFRC. Some of the most important projects now underway are as follow:

1. Identification and registration of native male date palm cultivars using morphological characteristics.
2. Improvement of Medjool date cultivar by hybridization.

3. Adaptability studies of promising genotypes and cultivars of date palm in new regions of the country.
4. Using nutrients and growth regulators to improve the fruiting of Barhee cultivar plants derived from tissue culture.
5. Adaptability studies of six oil palm cultivars in Fars province.
6. Evaluation of shade effect in reducing environmental stresses on banana and papaya compared to the open air.
6. Morphological and genetic diversity study of guava (*Psidium guajava* L.) in Iran.
7. Study on effect of different planting substrates and distances on vegetative growth, yield and quality of pineapple fruit in greenhouse conditions.
8. Identification of wood borer insects of date palm in Iran and their damage control through IPM.
9. Study on prevalence of date inflorescence rot in different cultivars.
10. Study on the causes of date palm leaf yellowing disease and date bunch fading disorder and its control approaches in Khouzestan province.
11. Optimization of date palm pollen extracting machine and electric pollinator design.

12. Investigation of physical and chemical methods in artificial ripening of date fruit.
13. Optimizing the propagation of selected date palm cultivars through in vitro and in vivo methods.

## Achievements

1. Registration of 10 superior and commercial native date cultivars using morphological characteristics in 2012.
2. Introducing a new native ber cultivar (Pishin) to grow in Balouchestan and south of Hormozgan regions of Iran.
3. Determination of vegetative and reproductive abnormalities of tissue culture-derived date palms and some of the anatomical causes of fruit set failure.
4. Optimization of pollination process (traditional and mechanized pollination methods) in date palm.

5. Detection of date palm leaf yellowing disease and date bunch fading disorder and providing primary effective solutions to reduce the damage in sensitive date cultivars.
6. Development of biological control methods for important date pests in date groves including supportive biological control of date palm spider mite by *Stethorus gilvifrons*, biological control of date palm lesser moth using bacteria *Bacillus thuringiensis* and microbial control of date's storage pests using fungus *Beauveria bassiana*.
7. Development of irradiation method to increase the shelf life of dates and mangoes in order to replace methyl bromide.
8. Design and manufacture of electric date palm pollinator, date leaf dethroning hand tool and date pollen extraction machine.
9. Development of irrigation and nutrition protocols to improve growth and fruit production in date palm and tropical fruits.

# Vegetable Research Center (VRC)

## Introduction

Vegetable products play an important role in sustaining food, creating occupations, having healthy diet and production profitability. According to 2020 fact sheets about 900 thousand hectares of cropping areas in Iran were dedicated to cultivation of vegetable crops.The turnover of vegetable markting is estimated to be more than 5 billion US dollars from 28 million tons of productions. At present, over 13 thousand hectares of greenhouses are dedicated to vegetable cultivation, which includes 70% of green-house productions.

Vegetable Research Center has 32 faculty members including 8 members in Karaj and 24 members in various research stations across the country.

## Research Infrastructure

- Three experimental greenhouses
- Experimental fields
- Three specialized labs entitled Genetic and Plant Breeding, Plant Protection, Physiology and Post-harvest Technology

## Main Research Activities

Research projects are carried out in different fields including Plant Breeding, Technology and Production Management, Technology and Post-harvest Physiology on different vegetable products in Solanaceae (Tomato, Pepper and Eggplant in greenhouses), Cucurbitaceae (Cucumber, Watermelon, Melon, Squash and Pumpkin), Root vegetables (Carrot, Radish, Parsnip, Turnip and Daikon), Leafy Vegetables (Spinach, Lettuce and Cabbage), Bulb Vegetables (Garlic) and Other New and Luxury Vegetables (Rucula, Fennel and other species).VRC has 24 running projects entiteld below:

1. Improvement of Sabzevar nuts watermelon population by mass selection.
2. A study on adaptability of advanced purple basil populations in Mazandaran and Isfahan provinces.
3. Investigating the quantitative and qualitative yield of 24 new clones and 3 maternal landraces of Iranian garlic (*Allium sativum* L.).
4. Study of morphological traits and yield of Iranian garlic land race to achieve superior clones.

5. Response of native melon accessions to cucurbit aphid-born yellow virus under the field conditions.
6. Study on pathogenicity variation of *Macrophomina phaseolina* the causal agent of melon and musk melon charcoal rot and the evaluation of melon and musk melon cultivars resistance.
7. The improvement of native melon (Sefidak) by S1 family selection in order to obtain improved populations.
8. Producing pure lines of greenhouse bell pepper (*Capsicum annuum*).
9. Producing pure lines of high brix content in greenhouse tomato (*Solanum lycopersicum*).
10. The comparison of planting pattern effect and seed rate on yield and control of internal infection in basil.
11. Evaluation of the planting bed components on yield characteristics of spinach, basil and dill genotypes in greenhouse conditions.
12. Optimizing the light spectrum and duration in plant factory systems for efficient use of water and land for lettuce (*Lactuca sativa*) plants.
13. Investigating the effect of intercropping of onion and lettuce on growth, yield and economical efficiency.

14. A study on some quantitative and qualitative characteristics of Iceberg lettuce varieties ( *Lactuca sativa*. L) in greenhouse conditions.
15. Investigating water deficit tolerance in Iranian native melon populations in outdoor conditions.
16. Exploiting of grafting technology in seedlings of greenhouse tomato and eggplant to enhance productivity.
17. Mechanized grafted-transplant production in greenhouse varieties of cucumber.
18. The effects of different planting beds on yield and qualitative characteristics of selected pepper genotypes under hydroponic production conditions.
19. Evaluation of different genotypes of greenhouse tomato in soil bed culture.
20. The evaluation of substrate's components on the yield characteristics of spinach, basil and dill genotypes in greenhouse conditions.

21. A study on optimizing the post harvest practices to decrease wastes.

24. A survey of tomato and eggplant rootstocks for diseases resistance.

25. Estimating the crop losses during harvesting and postharvest periods in vegetables products.

## Achievements

**Recently released cultivars:**

***Lactuca sativa* cv. Setareh**
Suitable for cultivation in temperate regions, Bolting tolerant

***Lactuca sativa* cv.Tavoosi**
Suitable for cultivation in Khuzestan province, Erect type

***Lactuca sativa* cv. Varesh**
Downy mildew tolerant,Suitable for cultivation in moderate humid areas

***Cucumis melo* subsp. *cantalopensis* cv. Samsoori 88**
Concentrated yield, 4-6 fruits per plant

***Cucumis melo* subsp. *inodorus* cv. Khatoni 93**
Uniform fruits with 12-13% of sugar content

***Cucumis melo* subsp. *inodorus* cv. Dargazi 93**
Suitable for cultivation in Khorasan province, Concentrated yield

***Cucumis melo* subsp. *cantalopensis* cv. Firouzi 99**
High uniformity in fruit, Average late mature, Good flesh diameter (4cm)

***Spinacia olerasea* cv. Varamin 88**
Harvesting 40 days after planting, High yield (47 ton/ha)

***Allium sativum* cv. Mazand**
Uniform, High yield (14 ton/ha)

**Varieties under release**

- ✓Six genotypes of melons
- ✓One genotype of spinach
- ✓One genotype of muskmelon
- ✓Roman and Iceberg lettuce genotypes
- ✓Nut pumpkin & nut watermelon genotypes
- ✓Diseases resistant cantaloupe genotypes
- ✓Basil genotypes
- ✓Greenhouse tomato genotypes
- ✓Garlic genotypes
- ✓Greenhouse peppers genotypes

## International Scientific Collaboration

Conducting mutual cooperation in of mushroom research projects confirmed in MOU between "Agricultural research, Education and Extension Organization (AREEO)-Iran" and "Yunnan Academy of Agricultural Sciences (YAAS)-China".

1. Preservation Methods of mushroom culture for long time without microbial contamination.
2. Methods of culture media preservation for Ganoderma, Shiitake, King Oyster Mushroom.
3. Determination of suitable formulations based on the cellulosic material available in country for the production of non-compost edible fungi.
4. Methods for preparing a suitable based on cellulosic waste products in country for the production of non-com posting edible fungi.
5. Workshop on cultivation of different non-compost mushrooms.

# Ornamental Plants Research center (OPRC)

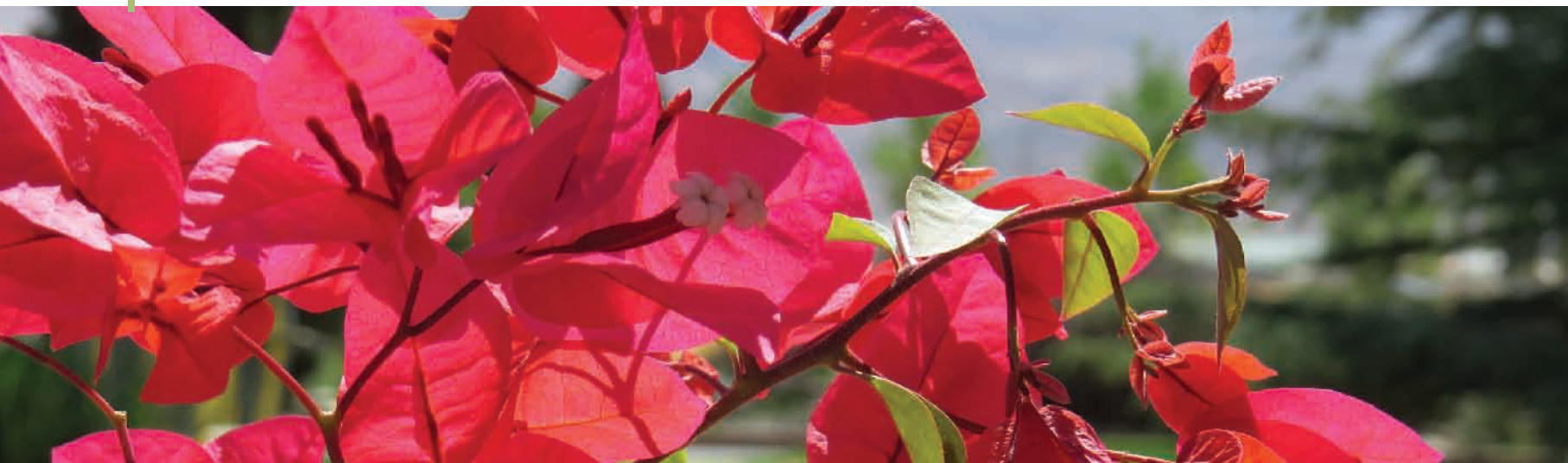

## The History

Flowers and ornamental plants play an important role in the development of healthy communities. More than 150$ billion annual turnover has been estimated for floriculture industry world wide. Due to the diverse climate and rich genetic resources of flowers and ornamental plants in Iran, there is the potential to use these resources to increase non-oil exports in the country. According to the statistics of 2020, 8000 hectares of arable lands in Iran have been allocated to the floriculture sector production in provinces of Tehran, Markazi, Mazandaran, Khuzestan (Dezful), Alborz and Guilan. Iran has produced 2,315 million cut flowers, 268 million seasonal plants (pot plants and seedlings), 166 million trees and shrubs in 2020.

In 1995, with the aim of expanding non-oil exports Flower and Ornamental Plants Research Station was constructed in Mahallat. In 2015, Ornamental Plants Research Station in Mahallat has been elevated to the Ornamental Plants Research Center (OPRC). Now, OPRC is the only professional and academic center of flower and ornamental plants in the region that attempts to provide the essential technical knowledge for development of floriculture industry through utilization of professional and academic experts and in collaboration with private sectors.

## Research Infrastructure

The research greenhouses cover an area of 5,600 $m^2$ of which 3,000 $m^2$ are intended for research projects and the rest is dedicated to commercial projects. For educational purposes, the ornamental



plants collections have more than 2,000 species and cultivars of seasonal ornamental plants, ornamental -medicinal plants, ornamental trees and shrubs, cacti and succulents. Also, the collection of ornamental geophytes has been developed in OPRC with more than 150 species and cultivars.

Four laboratories including plant pests and diseases, tissue culture, soil and water, molecular genetics, 3 units of growth chamber as well as 4 units of force room are other research infrastructures of OPRC.

## Main Research Activities

- Introducing new varieties of flowers and ornamental plants by collecting, evaluating, modifying, genetic engineering and classical breeding methods including Roses, Freesia, Gerbera, Gladiolus, Tuberose, Chrysanthemum, Iris, Zantadeschia, Petunia, Viola and Primrose.
- Providing and maintaining healthy and disease-free ornamental plants.
- Mass production and commercialization of different ornamental plants.
- Propagation of commercial varieties of flowering bulbs such as Lily, Tulip, Hyacinth and Gladiolus.
- Qualitative and quantitative improvement in the production of flowers and ornamental plants by optimizing new horticultural methods.
- Introducing cover and landscaping plants suitable for Iran's various climatic conditions with drought and salt tolerance priority.
- Determination of the best soil and soilless media

for ornamental plants with their water requirements.

- Determination of fertilizer and nutritional requirements for ornamental plants and the effects of biological fertilizers and anti-stress materials on water, salinity and nutritional stresses of ornamental plants.

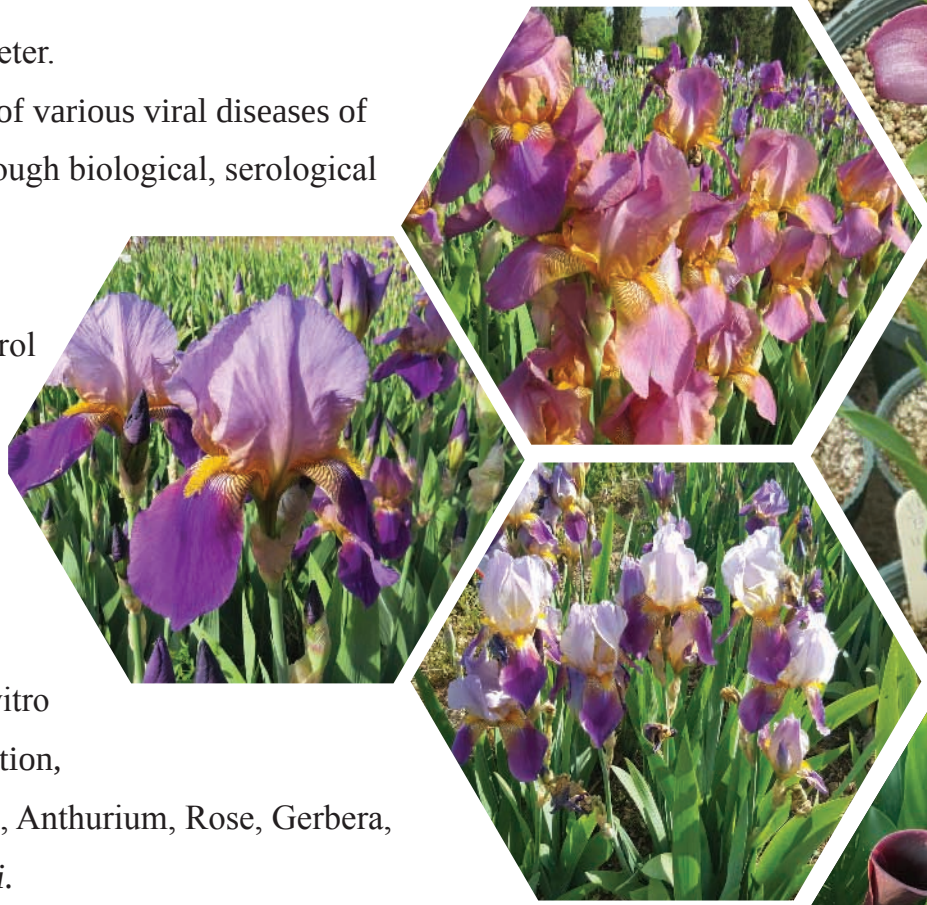
- The diagnosis of the most important pests and diseases, control methods, and natural enemies of ornamental plants in the used for biological control purposes.
- Investigating methods to reduce the use of pesticides.
- Investigating methods of integrated management of economic pests, diseases and permanent dangerous weeds.
- Studying the modern methods of physiology, propagation, reducing losses and improving quality standards of ornamental plants.
- Dormancy and forcing of bulbs - Physiology and postharvest treatments of cut flowers and potted plants.

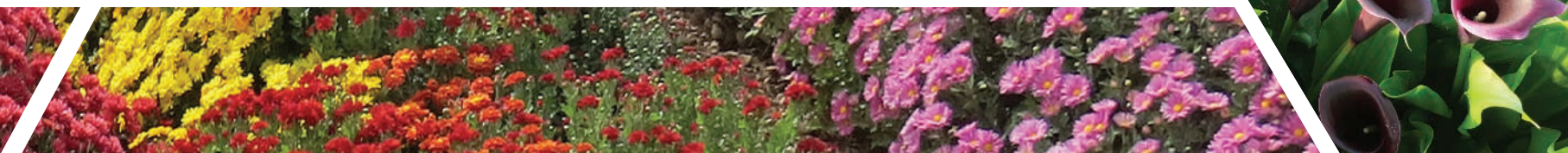
## Achievements

- Breeding of Chrysanthemum flowers, achieving 850 new genotypes through hybridization.
- Production and introducing of elite genotypes of Chrysanthemum, Carnation, Rose, pot Zantedeschia, Hippeastrum and Gladiolus by irradiation or inter-varietal hybridization.
- Production and introduction of superior genotypes of Iris and Freesia by hybridization.
- Nutritional optimization of some cut flowers such as Roses, Gerbera, Tube rose, Gladiolus, and Dianthus.
- Designing of measuring device for physical characteristics of

cultivation media- porosity meter.

- Detection and identification of various viral diseases of Amaryllis and Carnation through biological, serological and molecular methods.
- Effective control of trips in Carnation by biological control method using aurous bug.
- Controlling of mite in in Gladiolus bulb through physical treatments and predatory mites.
- Preparing instructions for in vitro culture of cut flowers, Carnation, Iris, Gladiolus, Zantadeschia, Anthurium, Rose, Gerbera, Lilium and *Lilium ledebourii*.





- Producing virus and disease-free flowers and ornamental plants.
- Developing of protocol to increase longevity of different cut flowers such as Rose, Gerbera, Carnation and Tuberose.
- Achieving protocol for the best storage condition of Tuberose bulbs.
- Improving the mechanical resistance to scape bending in Gerbera.
- Breeding of *Iris germanica* flowers, achieving 70 new genotypes of which 3 cultivars have been introduced.

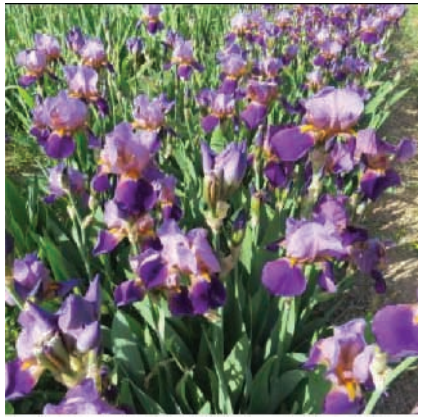
***Freesia hybrids* cv. Sholeh**
Reddish red color, Large and well color in flower, Good vase life, High branch number, High spike length, High number of floret

***Freesia hybrids* cv. Zarin**
Yellow color, Good vase life, High branch number, High spike length, High number of floret

***Freesia hybrids* cv. Sepideh**
White color, Large and well color in flower, Good vase life, High branch number, High spike length, High number of floret

***Iris germanica* cv. Elsa10**
Large flower, Good flowering duration, High branch number, High number of floret

***Iris germanica* cv. Elsa09**
Large flower, Good flowering duration, High branch number, High number of floret



***Iris germanica* cv. Elsa14**
Large flower, Good flowering duration, High branch number, High number of floret

# International Scientific Collaboration

✸ Signing a memorandum of understanding with Yunnan Academy of Agricultural Science (YAAS) China for the joint implementation of six research projects under the titles:

1. Production technology, germplasm exchange, molecular and classical breeding in ornamental plants.
2. Modern methods use to reduce water consumption and nutrient solutions in the cut flowers production in a hydroponic culture system.

**Exhibition of new cultivars of Chrysanthemum flowers**

3. Mass production of virus-free plants.
4. Production management of new varieties of ornamental plants.
5. Postharvest processing methods of flowers (various methods of flower drying, mummify, discoloration, staining and preserved rose production).
6. Forcing and adjust flowering time of bulbous and flowering indoor plants.

# Citrus and Subtropical Fruits Research Center

## The History

The CSFRC was established in 1930 as Falahat garden, but during the time its name was changed several times. In short, in March 2015, it was renamed to Citrus and Subtropical Fruits Research Center (CSFRC) and governed by Horticultural Sciences Research Institute (HSRI). Currently, the CSFRC is independently responsible for studying and investigating on Citrus, Kiwifruit, Feijoa, Pomegranate, Fig, Olive and Persimmon. The CSFRC is located in Ramsar town, a small beautiful coastal city of the Caspian Sea in Mazandaran province, Iran which is 291 Km far from Tehran. In Iran,the cultivation area of subtropical fruits is around 543700 ha, producing about 6.8 million tons of fruit annually.

There are 17 faculty members in Ramsar center, working in three research groups (Genetic and Plant Breeding, Technology and Production Management, Physiology and Post - harvest Technology). Meanwhile, 24 scientific members are working in 25 collaborative research stations. Research projects on citrus, oranges, tangerines, lemons and limes are being carried out at Ramsar and 3 relevant stations, also in agricultural research centers of Mazandaran, Fars, Hormozgan, Khuzestan and Kerman provinces. The research on olive is being conducted at the stations of Tarom, Rudbar, Kazeroon, Sarpol Zahab and Gorgan. Pomegranate research is also bing carried out at Saveh, Yazd, Fars and Khorasan Razavi stations and fig research projects at Estahban, Saveh, Lorestan and Kermanshah stations.

## Research Infrastructure

- There are three collections of citrus cultivars in Kotra, Dezfool and Jahrom research stations, holding 135, 195 and 70 genotypes, respectively. Two olive collections are located in Tarom and Aliabad katoul research stations. Furthermore, two pomegranate collections are placed in Yazd and Saveh research stations with 768 and 591 genotypes, respectively. Stahban research station as a fig collection contains 56 fig genotypes.

- Five specialized laboratories including Breeding, Physiology and Post - harvest Technology, Central (Molecular) lab, Plant Protection, Soil and Water lab; Research greenhouse; Indexing greenhouse; Virus bank; Screenhouse (for vector assays); Phytotron and Research cooling storage.

## Main Research Activities

Today, the CSFRC is a premier center for research on citrus and subtropical fruits. The major activities of CSFRC are as follows:

- Production of new subtropical varieties using mutation breeding and natural selection methods.
- Providing healthy nuclear stocks of demanded commercial cultivars using Shoot Tip Grafting Technique (STG) combined with thermotherapy.
- Access to technical knowledge on production of tolerant lime cultivars against WBDL.
- Construction of the national olive germplasm collection in Tarom Olive Research Station by the support of International Olive Council (IOC).
- Evaluation of resistance of different citrus, olive, pomegranate cultivars to biotic and abiotic stresses.

- Evaluation and introduction of fertilizers, pesticides, fungicides and fruit waxes for sub tropical cultivars.
- Consultation on harvesting, transporting, sorting, packaging and storage of subtropical fruits.

## Achievements

**Newly released cultivar:**

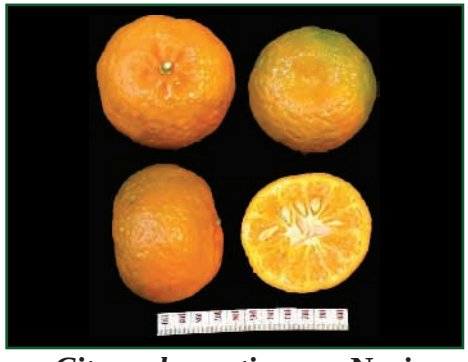

***Citrus reticulata*** **cv. Jahangir**
**Early ripening**


***Citrus reticulata*** **cv. Khoram**
**Early ripening**

***Citrus reticulata*** **cv. Yashar**
**Late ripening**


*Citrus reticulata* **cv. Noushin**
**Early ripening**

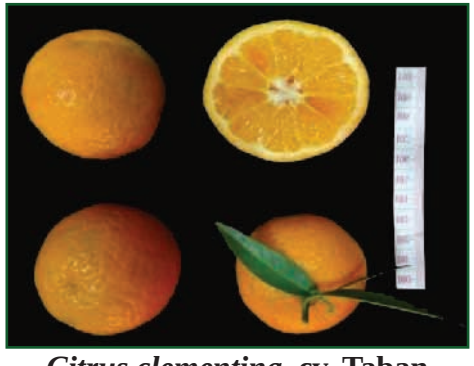

*Citrus reticulata* **cv. Shahin**
**Late ripening**



*Citrus clementina* **cv. Narin**
**Late ripening - Cadox clone**

*Citrus clementina* **cv. Zarrin**
**Early ripening - Cadox clone**

*Citrus clementina* **cv. Tabesh**
**Semi seedless - Cadox clone**



*Citrus clementina* **cv. Taban**
**Seedless - Cadox clone**

***Olea europaea* cv. Meshkat**

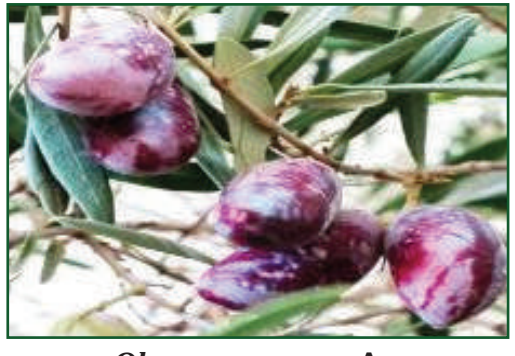
**Dual purpose, Late ripening**

***Olea europaea cv.* Direh**

**Suitable for olive processing**

***Olea europaea* cv. Amin**

**Suitable for oil prouduction, Dwarf**



***Olea europaea* cv. Avan**

**Suitable for oil prouduction in subtropical area**

- Production of 27 citrus healthy commercial cultivars by STG.
- Increasing water productivity through application of shade mesh, improving nutritional efficiency using the best fertilization method and different fertilizer sources.
- Determining the standards of traditional storage for citrus fruits and reduction of citrus losses during storage.
- Introducing NaOH-free olive de-bittering method.
- Introducing modern propagation method for olive (semi-hardwood cuttings under mist system).
- Determination of water requirement for commercial subtropical cultivars.
- Determination of optimal harvesting time for subtropical fruits.
- Reducing damage to Ectomyelois ceratoniae, cracking and sunburn in commercial pomegranate cultivars.

## International Scientific Collaboration

- Construction of the national olive germplasm collection in Tarom Olive Research Station by the support of the International Olive Council (IOC).
- Codifying of Kiwifruit Codex in collaboration with New Zealand and Mexico under the supervision of "Codex Committee of Fresh Fruits and Vegetables"

# Temperate Fruits Research Center (TFRC)

## The History

Temperate fruits production is considered as a major industry in Iran, covering 1.2 million ha of 2.6 million ha allocated to planting of fruit trees in the country. Temperate Fruits Research Center (TFRC) consists of three research groups (Genetic and Plant Breeding, Technology and Production Management, Physiology and Post-harvest Technology), with more than 80 researchers and 26 local research stations. There are 69 faculty members in Karaj center including associate and assistant professors, and technicians working in three research groups. A total of 46 researchers are also workng in Three research stations throughout the country.

## Research Infrastructure

TFRC has two research stations in Karaj including collection orchards and experimental units for a number of fruit trees such as apple, pear, quince, apricot, sweet and sour cherries, plums and prunes, hazelnut, almond and walnut. There is also a propagation greenhouse and screen house in Karaj. Three laboratories including physiology and tissue culture, molecular laboratory, and post-harvest physiology laboratory are other research infrastructures.

## Main Research Activities

The research activities of TFRC are designed and conducted based on the development roadmap in each of three research groups. Although these research groups are defined separately, their activities are related to each other and lead to introducing of new cultivars that are adapted with different climatic conditions of the country.

Some current important research activities are:

1. Achieving dwarf vegetative apple rootstocks.
2. Development of rainfed gardens on sloping lands.
3. Evaluating the effect of shade nets to reduce the damage of biotic and abiotic stresses in some temperate zone fruits.
4. Evaluation of adaptability of promising almond genotypes.
5. Evaluation of drought tolerance in some commercial almond cultivars.
6. Water consumption management based on modern methods in almond orchards.
7. Phenological and pomological characterization of almond progenies.
8. Identification of superior native and foreign walnuts.
9. Respons of promising walnut hybrids to *marssoniella juglandis,* causal agent of anthrachose.

10. Morphological and molecular study of the sweet cherry clones.
11. Commercialization of some promising genotypes of cherries.
12. The production of virus-free seedlings of two promising cherry cultivars.
13. Providing of healthy nuclear stocks of four new walnut cultivars to establish pre-basic and mother blocks.
14. Development of rainfed vineyards in semi-arid regions.
15. Rejuvenation of old orchards by top-working technique (walnut, cherry and grapevine).
16. Evaluation of tolerance to salinity in selected grapevine genotypes.

17. Achieving new apricot varieties by crossing between Iranian and foreign cultivars.

## Achievements

✦ The first foreign cultivars of apple, hazelnut, grape, almond, cherry, peach and strawberry as well as rootstocks of apple and stone fruits were imported from Italy, France, Russia and Belarus during 1961-2005.

✦ Germplasm Preservation: Many promising local genotypes, old cultivars and emerging cultivars have been maintained in form of collection orchards. The area of the collections was equal to 8 hectares in 1946, reaching to 25 hectares in 1977, and have expanded to more than100 hectares, recently. The collections are being maintained in 9 stations throughout the country.

✦ Publications: More than 35 books and 475 papers have been published. A booklet entitled “Fruit Cultivars, in the Past and Future “has been published by

HSRI involving all details about old commercial, newly introduced cultivars and promising genotypes of temperate and cold zone fruits related to this research center. The TFRC has currently finalized breeding program guidebook in order to cover all fruit crops to serve as a mid-term roadmap.

✦ Releasing 112 local and adopted foreign cultivars and introducing them to diverse sites.

In the case of rootstocks, adaptability and suitability of old and well known dwarfing rootstocks including Malling series (M26, M9, M7) and Malling-Merton series (MM111, MM106) for apples, Pyrodwarf, Quince A, B, C for pears, Tetra, Penta, G.F./G.N. series, Myrobalan, Mariana, St. Julian for stone fruits (except cherries) and Colt and MF12/1 for cherries, to establish compact orchards in climatic conditions of Iran.

## Newly released cultivar

***Prunus armeniaca*** **cv. Sahand 97**

**Late ripening, Suitable for processing & transport**


***Prunus armeniaca*** **cv. Shanly**

**Large fruit size, Excellent taste**

***Prunus armeniaca*** **cv. Parsi**

**Large and colorful fruits, Excellent taste, Free stone**

***Prunus armeniaca*** **cv. Jalil**

**Fleshy and large fruits, Fresh and dried use**

***Prunus avium* cv. Shandiz**

**Early ripening, High quality fruit, High fruit weight**

***Prunus avium* cv. Toos**

**Early ripening, High fruit weight, High quality fruit, Short pedicle**

***Prunus avium* cv. Adli**

**Very early ripening**

***Corylus avellana* cv. Pashmineh 89**

**Vigorus, No bud failure**

***Corylus avellana* cv. Gerdouei 89**

**Vigorus, No bud failure**

***Juglans regia* cv. Persia**

**Late leafing, Lateral bearing,**
**High kernel percent**

***Juglans regia* cv. Caspian**

**Late leafing, Lateral bearing,**
**High kernel percent**

***Juglans regia* cv. Alvand**

**Lateral bearing, Very low vigour**

***Juglans regia* cv. Chaldoran**

**Precocious, Lateral bearing**

***Prunus dulcis* cv. Aidin**

**Very late blooming, Spur type**

***Prunus dulcis* cv. Saba**

**High yield, Spur and shoot bearing**

***Malus domestica cv. Sharbati***

**Early ripening, Very sweet and juicy**

***Malus domestica cv. Golbahar***

**Early ripening**

***Cydonia oblonga* cv. Viduja**
**Notable fruit quality, Relatively resistant to fire blight disease**

***Cydonia oblonga* cv. Behta**
**Juicy fruit, Relatively resistant to fire blight disease**

***Vitis vinifera* cv. Amin**
**Good storage life, Semi seedless, High sugar content**

***Vitis vinifera* cv. Rajan (Razhan)**
**Seedless - Sultana clone, High yield**

***Vitis vinifera* cv. Monoodar**
**Early ripening, Large and well color berries**


***Ziziphus jujuba*** **cv. Siojan**
**Vigorous trees, Large fruits, Fresh and dried consumption**


***Ziziphus jujuba*** **cv. Majan**
**Vigorous trees, Large fruits, Fresh and dried consumption**


***Vitis*** **sp. Hybrid Spota**
**Rootstock Very resistant to crown gall disease**


***Vitis*** **sp. Hybrid Nazemiyeh**
**Rootstock Very resistant to crown gall disease**

## International Scientific Collaboration

TFRC has committed agreements for joint research activities with the following international centers:

- Instituto Sperimentale Per La Frutticoltura , Rome , Italy (ISF), Cooperation with this institute led to the training of a significant number of colleagues by traveling to participate in short and mid-term raining workshops. Also, a number of scientists from this institute held training courses in Karaj. Some germplasm of temperate fruit trees were also exchanged for the use in research projects.
- Scientific cooperation with The Republican Research and Production Unitary Enterprise, «Institute for Fruit Growing» (the Republic of Belarus).
- Joint research collaboration with Horticultural Research Center of Hungary for cherries and walnut breeding.


OUR MISSION IS TO BOOST THE INNOVATIVE,
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