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Review article

PRODUCTION OF CROPS IN TURKEY AND RESEARCHES AT THE FOOD ENGINEERING DEPARTMENT

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A b s t r a c t. Turkey ist a major producer and exporter of various agricultural products, and organic agriculture in Turkey started with the international demand from major export partners. Production has been realized according to the standards and certification systems of the importing countries, which were mainly EU countries. Currently 103'190 hectares are managed organically, which corresponds to 0.4% of the total agricultural area. Turkey is the largest country among the Candidate and Accession Countries with the lowest per capita income. Agriculture in Turkey is still the most important source of employment and provides income and subsistence for the vast majority of the rural population. Turkish agriculture is characterised by very small size farms, most of them subsistence farms. The main products are fruit and vegetables in the coastal regions and livestock and meat in the extensive mountainous areas. Turkey is a net exporter of agricultural and food products. Its main trade partners are the EU and the Candidate and Accession Countries. Important other trade links exist as well with the USA and countries in the Mediterranean basin and the Arab Gulf. In this paper, the situation of crop production in Turkey and the studies at the Food Engineering Department, Ege University, are given briefly.

K e y w o r d s: Crops, Turkey, Ege University

INTRODUCTION

Turkey is an agricultural country and has a considerable amount of agricultural produc-tion potential in terms of soil, climate and water resources. Forest land occupies about 42 percent of the country, and 40 percent of agricultural land is occupied by field crops, fruit-trees and vegetable crops. Agriculture has got a very important place in the Turkish economy. The main crops are wheat, rice, cotton, tea, tobacco, hazelnuts, and fruit. Turkey is one of European wool and cotton producers. Among the field crops, cereals are followed by pulses, oilseeds and tuber crops. The production of crops is given in Tables 1-4.

Table 1. Production of leguminous Plants in Turkey (tonnes)

Year	Broad bean	Peas	Chıckpea	Bean	Lentıl	Vetch
1995	49000	3900	730000	225000	665000	7300
1996	46300	4000	732000	230000	645000	6000
1997	46000	3900	720000	235000	515000	6100
1998	42500	3100	625000	236000	540000	5000
1999	39000	3000	560000	237000	380000	4250
2000	37000	3100	548000	230000	353000	3600
2001	35000	2700	535000	225000	520000	3000
2002	32000	4000	650000	250000	565000	3000

Table 2. Production of grains in Turkey (tonnes)

Year	Wheat	Barley	Rye	Oat	Corn	Rice
1995	18 million	7.5 million	240000	250000	1.9 million	150000
1996	18.5 million	8.0 million	245000	275000	2.0 million	168000
1997	18.7 million	8.2 million	235000	280000	2.1 million	165000
1998	21 million	9.0 million	232000	310000	2.3 million	189000
1999	18 million	7.7 million	233000	290000	2.3 million	204000
2000	21 million	8.0 million	260000	314000	2.3 million	210000
2001	19 million	7.5 million	220000	265000	2.2 million	216000
2002	19 million	8.3 million	255000	290000	2.1 million	216000

Table 3. Production of oil seeds in Turkey (tonnes)

Year	Sunflower	Sesame	Peanut	Soy	Safflower	Rapeseed
1995	900000	30000	70000	75000	125	9
1996	780000	30000	80000	50000	74	5
1997	900000	28000	82000	40000	65	10
1998	860000	34000	90000	60000	72	300
1999	950000	28000	75000	66000	50	330
2000	800000	23000	78000	45000	18	187
2001	650000	23000	72000	50000	25	650
2002	850000	22000	90000	75000	25	1500

Table 4. Production of industrial plants in Turkey (tonnes)

Year	TOBACCO	SUGARBEET	COTTONSEED
1995	204000	11.2 million	1.3 million
1996	225000	14.5 million	1.2 million
1997	286000	18.4 million	1.2 million
1998	251000	21.9 million	1.3 million
1999	251000	16.9 million	1.3 million
2000	208000	18.8 million	1.3 million
2001	154000	12.6 million	1.4 million
2002	153000	16.5 million	1.5 million

DEVELOPMENTS IN TURKEY

The Southeast Anatolia Project (GAP) will give rise to great changes concerning the areas sown and production levels. The most important project of the late 80's and early 90's is the GAP which is linked with the 2,400-megawatt Atatürk Dam on the Euphrates River and is expected to irrigate 1.7 million hectares when it is completed in 2002. The system consists of a twin-bore 24.6-kilometer tunnel which will take water from the reservoir to irrigate the plains around Harran, Mardin, and Ceylanpinar in southeastern Turkey. In the GAP region, farmers face a six-month dry season allowing them only one cash harvest per year. Irrigation will probably enable expansion to two or even three harvests. Crop rotation, which is largely unknown in areas without irrigation, has been introduced in the GAP region. Winter vegetables are expected to alternate with cotton as the summer crop. Although wheat and pulses dominate cropping patterns, cotton could take a larger share as access to water increases. The government projects that the GAP will increase Turkish wheat production by more than 50 percent, barley by a similar figure, and the region's production of cotton by more than four times by 2005, thus increasing national cotton production by 60 percent. The value of food surpluses expected to result from this project is estimated at US$ 5 billion.

EGE UNIVERSITY

Ege University, established in 1955, currently consists of 11 Faculties, 5 Schools (four years), 8 Vocational Training Schools (two years), 7 Institutes and 21 Research Centers. There are 2809 academic and 3609 administrative staff. In 2001-2002 academic year 30,887 students (27,630 undergraduate and 2877

graduate students) enrolled in Ege University. Founded in 1982, Ege University, Faculty of Engineering is made up of nine departments: Computer Engineering, Leather Engineering, Bio-Engineering, Food Engineering, Mechanical Engineering, Chemical Engineering, Textile Engineering, Electrical Engineering, and Civil Engineering.

FOOD ENGINEERING DEPARTMENT

Food Engineering is a branch of engineering where physical, chemical and biological sciences can be applied in the processing, transporting, storing of foods and the production and development of new foods. Food Engineering program aims to provide graduates with the knowledge and skills that can be applied to design, develop and manufacture safe, high quality, value added food products and production and distribution systems for the benefit of mankind. The basic functions of a food engineer are:

- to produce healthy and nutritive foods,
- to develop new process techniques based on the biochemical, technological and economical processes,
- to evaluate raw materials, to prevent the loss of food sources by keeping the quality and quantity,
- to produce new foods from waste materials,
- to produce new types of food products.

Besides these functions, the Department of Food Engineering follows the developing techniques on food science and food processing, applies these techniques on industrial level and conducts scientific researches for producing new techniques. One of the basic aims of Food Engineering Department is to increase the number of food engineers for our developing food industry. The Department of Food Engineering of Ege University has 31 professors and lecturers, 22 research scientists, 77 post graduate students, 15 technical and 3 administrative staff. It occupies an extensive Food Processing Hall and specialised laboratory facilities. Food Engineering Department has different Academic Units, as follows:

A. Food Science

*Food Microbiology Section
*Food Chemistry Section
*Food Quality Control Section
*Nutrition Section

B. Food Technology

*Unit Operations of Food Engineering Section
*Fruit and Vegetable Processing Technology Section
*Dairy Processing and Engineering Section
*Cereal Processing and Engineering Section
*Meat Technology Section
*Oil and Fat Technology Section
*Biotechnology Section
*Food Packaging Section
*Food Economics and Industrial Management Section

There are 20 research laboratories and a number of pilot plants. The research laboratories in the Food Engineering Department are equipped with modern apparatus and equipment for analysis and quality control of foods. In addition to complete processing lines for dairy products (3 tons milk/day), processed meats (1.5 tons meat/day), fruit juice production (0.5 tons juice/day), neutralizing, bleaching and deodorization equipments for edible oil refining and dead-end type hydrogenation reactor, the following pieces of pilot scale equipment are used for industrial researches and in student practical sessions.

LABORATORIES IN FOOD ENGINEERING DEPARTMENT

A. Food Microbiology Laboratory

In food microbiology laboratory, detection of pathogen bacteria such as Salmonella, Listeria, E.coli 0157:H7 are carried out by approved conventional methods. Some enterotoxin analysis are done by ELISA method. Spoilage flora of different foods are investigated and shelf life determination works are studied. On the other hand, for traditio-nal products, commercial starter culture development studies are continued.

Some Equipments

Anaerobic Jar
Centrifuge (10000 rpm)
Heating/Cooling Incubator
Laminar Flow Cabinet
Phase-Contrast Microscope
Stereomicroscope
UV Sterilizator

B. Dairy Technology Research Laboratory

In dairy technology research laboratory, specific analysis for milk and dairy products like yoghurt, cheese, butter, milk powder, etc. are carried out to

determine the composition of these products, to determine whether they comply with the standards and regulations, and to classify the products and to set the characteristics of the products.

Some Equipments
Gerber centrifuges
Laboratory type homogenizer
Santrfuge (

Pilot Plants

In dairy processing pilot plant, pasteurisation and processing of milk and manufacturing of yoghurt can be shown in tutorial practices and researches can be conducted.

Some Equipments
Butter churn
Butter packaging machine
Cheese vats
Ice cream machine
Pasteurisation line
- Plate heat exchanger
- Homogenizer
- Separator

Viscubator
Yoghurt packaging machine

C. Cereal Processing and Engineering Laboratory
Equipments
Amilograph
Balances
Buhler, laboratory mill, for wheat milling
Extensograph
Falling number device
Farinograph
Kjeltech protein analysis equipment
Mixograph
Moisture determination equipments
Reduction rolls (High circulation endless, worm wheel feeding)
Shaker
Sieves
Various lab. type of wheat mills

Waterbath
Specific Analysis
Acidity analysis
Amilograph
Ash analysis
Bread baking test for wheat flours
Determination of cooking range of pasta
Determination of extraction rate of white rice from rough rice
Determination of starch damage in flour
Determination of the effects of additives on bread quality
Determination of wet and dry gluten in wheat flour
Enzyme activity (Falling number)
Extensograph
Farinograph
Milling test
Moisture analysis (oven method and Ultra X)
Oil analysis (Soxhelet extraction)
Percentage of solid substance lost in water
Protein analysis (Kjeldahl)
Sedimentation test (for wheats and flour)
Sieve analysis

D. Biotechnology laboratory

Equipment
Analytical balance
Autoclave
Circulatory cooler
Cooled incubator
Fermentation system
Magnetic and hot plate stirrers
Microcentrifuge
Microwave oven
Nuvemix tube shaker
O_2 meter
Oven
Peristaltic pomp
pH-meter
Refrigerator
Saccharification equipment
Spectrophotometer

Temperature controlled shaker
Water purification system
Waterbath

D. Oil and fat technology laboratory
Equipments
Active Oxygen Method (AOM) equipment
Oil stability analysis
Rotary evaporator and vacuum pomp
Soxhelet extraction systems
Specific Analysis

E. Meat technology laboratory
Equipments
Incubator
Moisture analyser
Refrigerator
TBA equipment
Specific Analysis
TBA analysis

F. Fruit & vegetable processing technology laboratory
Equipments :
Analytical balance
Heating mantle
Oven
Refractometer
Refrigerator
Vacuum oven
Waterbath
Specific Analysis :
Sulphurdioxide analysis

G. Food packaging laboratory
Specific Analysis :
Plastics identification
Total migration analysis

PROJECTS IN FOOD ENGINEERING DEPARTMENT

A list of current projects under study is given with relevant details and annual reports available in Food Engineering Department. The Department of Food Engineering cooperates in bold and innovative ways with other higher education institutions, including other state universities, community colleges, research centers, technical colleges, private colleges and others, as well as with commodity groups, business, industry and community action groups from Turkey and other countries.

These new educational and research partnerships have burgeoned between institutions of higher education as ways have been found to improve research projects and curricula. In addition, such partnerships eliminate redundant programs and course offerings, and involve all affected individuals and institutions in improving the research projects and the institutions that serve them. Collaboration among these institutions and agencies has increased dramatically since the national and international contacts developed.

The quality of inter-institutional collaborations has also increased significantly as values and aspirations of participating institutions have been introduced and enhanced through involvement with partnerships of projects. Several partnerships and collaborations involved with the projects of Food Engineering Department have been instrumental in helping staffs projects successfully compete for external funds.

RESEARCH PROJECTS IN FOOD ENGINEERING DEPARTMENT

A. Food Quality Control Section

*Determination of shelf life of an emulsion type meat product (sausage) and its mathematical model.

*A study of the possibility of applying the new developing methods used for the determination of common wheat in pasta products of Turkish wheat.

*A study on drying techniques of grilled aubergine and the determination of its quality characteristics.

*Quality changes of processed dried apricots during storage.

*Determination of flavour compounds that effect the sensory quality of mandarin fruits cultivated in the Aegean region and investigation of the changes which occur during storage.

B. Food Microbiology Section

*Microbial laccase production from olive mill wastewater

*Survival and inactivation of foodborne pathogens in some fruits & vegetables

*Detection of *S.aureus* and its enterotoxins in some cheeses sold in İzmir.

*Acid tolerance response of some pathogen microorganisms.
*Biological control of molds.
*Investigation of biofilm formation in food industry.
*Isolation of nisin producing L.lactis and factors effecting nisin production.
*The effect of organic acid and phosphate treatment on the shelf-life of turkey meat.
*The effect of drying and processing on microbiological quality of dried apricot production.

C. Nutrition Section
*Antioxidant activity of phenolic compounds in some foods using in-vitro methods.
*Determination of the antioxidant effect of total phense composition on in-vitro low density lipoprotein (LDL) oxidation.

D. Food Chemistry Section
*The analyses of mono and diglycerides of fatty acids (E- 471) as additive component in Turkish Food Industry.
*The determination of the antioxidant activity of rosemary extracts in refined sunflower oils.
*The researches on the major phenolic compounds (flavanols,flavonols, tannins) and aroma properties of black teas.
*The researches on the major chemical components and aroma characteristics of teas sold in Turkish local markets
*‘Resveratrol’(3,5,4’- trihydroxistilben) contents of edible peanuts grown inTurkey.
*The effects of fish oils on hens performance and some egg properties.
*The chemical composition of major varieties of hazelnut grown inTurkey and of hazelnut oils and the detection of the hazelnut oils in olive oils quantitatively.
*Analyses of biogenic amines in foods by high performance liquid chromatography (HPLC).
*Histamine in fermented foods. Studies on cheese, wine and pickled cabbage PUFA (Polyunsaturated fatty acids) levels in fish oil capsules.
*The determination of the pesticide residues in some vegetables grown in greenhouses.
*The determination of the pesticide residues in some raisins grown as classic and ‘ıpm’ in Aegean region.

E. Food Packaging Section
*Determination of the amount of solvent reside in plastic packaging materials.
*Prevention of peel-off lacquer in lacquered tin plates used in tomato paste industry.
*Use of isooctan as a fatty food simulant for determination of migration values of some plastic materials which are used in packaging of fatty foods.
*Determination of migration properties of PET bottles used for packaging of soft drinks containing carbonic acid.

F. Dairy Processing and Engineering Section
*The effects of some fat replacers on the properties of reduced kaşar cheese.

G. Cereal Processing and Engineering Section
*The possibilities of glucose syrup usage in bun.
*The agricultural and technological specification of the wheat produce as a second product with several manuring techniques in different cultivation times.

H. Meat Technology Section
*Using dairy based additivies in various types of turkey products.
*The effects of using onion juice and rosemary extract on oxidative stability of sardina (sardina pilcharus, walbaum, 1972) meat.

I. Oil and Fat Technology Section
*The use of processing aids in olive oil extraction.

J. Unit Operations of Food Engineering Section
*Thermal conductivityy measurements of food products under freezing conditions.
*Measurements of thermal properties of some food materials.
*Destruction kinetics of some quality characteristics (colour, flavor) and modelling during dehydration and storage of onion slices.

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PRODUKCJA PŁODÓW ROLNYCH W TURCJI ORAZ BADANIA PROWADZONE NA WYDZIALE INŻYNIERII ŻYWNOŚCI

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S t r e s z c z e n i e . Turcja jest jednym z ważniejszych producentów i eksporterów produktów rolniczych, a rozwój rolnictwa organicznego w Turcji rozpoczął się wraz ze wzrostem zapotrzebowania międzynarodowego ze strony głównych partnerów eksportowych. Produkcja była realizowana zgodnie z normami i systemami certyfikacyjnymi krajów importujących, w tym głównie kracjów Unii Europejskiej. Aktualnie uprawy organiczne obejmują obszar103.190 hektarów, co stanowi 0,4% całości obszarów użytkowanych rolniczo. Turcja jest największym krajem wśród krajów Kandydackich do członkostwa w UE, przy czym posiada najniższy dochód na głowę mieszkańca. Rolnictwo w urcji jest nadal najważniejszym źródłem zatrudnienia i zapewnia dochód i podstawę utrzymania dla ogromnej większoći ludności obszrów wiejskich. Rolnictwo turecke charakteryzuje się bardzo małą wielkością gospodarstw, z których większość produkuje wyłącznie na potrzeby własne. Głównymi produktami są owoce i warzywa w rejonach nadmorskich, oraz produkcja żywca i mięsa na rozległych obszarach górskich. Turcja jest eksporterem netto produktów rolnych i żywności. Główni partnerzy handlowi Turcji to kraje UE oraz kraje kandydackie do członkostwa w UE. Istnieją także inne ważne powiązania handlowe, głównie z USA, krajami basenu Morza Śródziemnego oraz Zatoki Perskiej. W niniejszej pracy przedstawiono sytuację produkcji rolnej w Turcji oraz pokrótce omówiono zakres badań prowadzonych na Wydziale Inżynierii Żywności Uniwersytetu Ege.

S ł o w a k l u c z o w e : płody rolne, Turcja, Uniwersytet Ege