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National Agricultural Research Systems Strategies towards Food Security: The Case of Türkiye

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Abstract. Nations have to secure enough food for their growing population. Thus, it is vital for developing nations to produce necessary food domestically. There are different policy options for attaining food security, such as self-sufficiency in food production, and agricultural development, where agricultural research can interfere. In this paper, some facts about agriculture in Türkiye is examined. The role of National Agricultural Research Systems (NARS) towards food security is explained, and Agricultural Research in Türkiye is summarized. The conclusion is that NARS can play an important role in enhancing the income of the poor thereby increasing food security in a given country.

Key words. Food Security – Self-Sufficiency – Agricultural Development – Agricultural Production – National Agricultural Research Systems (NARS) – Agricultural Research Strategies – Consumption

Titre. Stratégies du Système National de Recherche Agricole pour la sécurité alimentaire : cas de la Turquie.

Résumé. *Les nations doivent assurer une production suffisante pour nourrir une population croissante. Il est ainsi vital pour les pays en développement de produire sur place les biens alimentaires nécessaires. Il existe plusieurs politiques permettant d'atteindre la sécurité alimentaire, tels que l'autosuffisance en produits alimentaires et le développement agricole, où la recherche agricole peut intervenir. Certaines caractéristiques de l'agriculture turque sont ici examinées. Ensuite, nous expliquons le rôle du Système National de Recherche Agricole (SNRA) en Turquie, et présentons de manière synthétique la recherche agricole dans le pays. Nous concluons que le SNRA peut jouer un rôle important pour améliorer les revenus des pauvres et, de ce fait, accroître, dans un pays donné, la sécurité alimentaire.*

Mots clés. *Sécurité alimentaire – Autosuffisance – Développement agricole – Production agricole – Système National de Recherche Agricole (SNRA) – Stratégies de recherche agricole – Consommation*

I. – Introduction

Food is a basic human need. Nations have spent a considerable amount of their national budget to secure enough food for their population. Food can be provided either through domestic production or trade or both. Both trade partners can gain from trade. However, it is vital for a country to produce necessary food domestically for its population. Therefore, investment in agriculture is crucial for a nation's survival. This is especially important for less developed countries where almost all the famines have taken place throughout history.

In a country, the sole cause of food insecurity is the the lack of food resulting from a lower agricultural production, Yet, overcoming this difficulty is not necessarily the only measure for food security. Other means for food security, such as trade, require high household income. On the contrary, if invested in agriculture by governments, households can generate sufficient food for its members, and also income for trade.

Food security has been defined in different ways by many authors (Adelman and Berck, 1988). Some are as follows:

At the aggregate level, food security is the ability of a province, nation, or region to meet target food consumption on a sustainable basis (Heisey, 1992). At household level, it is the access by all people at all times to a sufficient amount of food for an active and healthy life (World Bank, 1986; Von Braun et al., 1992).

Two types of household food insecurity—chronic and transitory can be distinguished. In reality, they are closely intertwined (World Bank, 1986).

Chronic food insecurity is a persistently inadequate diet resulting from the continual inability of households to acquire necessary food either through market purchase or through production. It is rooted in poverty. Transitory food insecurity is a temporary decline in a household's access to needed food, due to factors such as instability in food prices, production or incomes.

Seasonal variations in production is one of the most crucial factors contributing to transitory food insecurity of poor households which can escalate over

time into chronic food insecurity and nutritional deterioration (World Bank, 1986; Von Braun et al., 1992).

Small-scale farmers or tenants whose crops have failed and landless agricultural workers who lose their job when agricultural production declines are the typical victims of food insecurity (World Bank, 1986). A country and its people are food secure when production markets, and social systems work in such a way that food consumption needs are always met (market-oriented economy) (Von Braun et al., 1992), provided that consumers income is sufficient.

Different policy options are proposed for attaining food security (World Bank, 1986; Adelman and Berck, 1988; Von Braun et al., 1992) which can be:

i) the accumulation of buffer stocks aimed at stabilizing the world price of agricultural goods, and ensuring supply availability,

ii) an international insurance scheme to cover higher-than-trend food import bills,

iii) trade-oriented policies,

iv) food aid by developed countries,

v) price subsidy schemes to consumers or production-subsidy schemes to producers,

vi) self-sufficiency in food or production oriented policies,

vii) agricultural development,

viii) raising the income of the poor.

Concerning the last three proposals, agricultural research can interfere. Agricultural research provides an agricultural system that is less vulnerable to weather changes and cost-effective production techniques. Along with many other factors, food security can be increased by raising the real household income of the poor farmers. The results and design of basic discipline-oriented research programs should be sufficiently integrated into practical interdisciplinary efforts to understand agricultural systems and solve some major problems of farmers, thereby increasing household agricultural income.

Certain poor households are chronically food insecure and others are at risk (Heisey, 1992). Although food insecurity is a lack of purchasing power of people and nations, and food security does not necessarily result from achieving food self-sufficiency in a country or from a rapid increase in food production (World Bank, 1986; Rukini and Eicher, 1987). The essential elements of food security at any level are the availability of food and the ability to acquire it (Heisey, 1992). Therefore, along with other factors, food self-sufficiency, in developing countries and/or low-income countries, is a necessity for food security, i.e, self-sufficiency may lead to food security in such countries.

Agricultural growth does not also mean food security (Rukini and Eicher, 1987). In the long run food security is a matter of achieving economic growth and alleviating poverty. In the short run, it is a matter of redistributing purchasing power and resources toward those who are undernourished (World Bank, 1986). Agricultural growth may partially lead to economic growth, or it may well increase the purchasing power of the poor in rural areas, which is still important for Türkiye with 41% of the population engaged in agriculture. The population growth has outstripped food production in the world, especially in developing countries. The population growth in the rural areas is even higher. Therefore agricultural growth and farm income increase are especially important for the poor although the long term average population growth rate of Türkiye is still less than the average growth rate of agriculture with 3.7%. The reallocation of the economy's capital stock represents an agricultural development-led-industrialization strategy in which agricultural productivity is increased by increasing investment in agriculture (Adelman & Berck, 1988).

Food security can be improved in the short and long run through various means. Agricultural research is one that can indirectly and in short period of time improve household food security. Technological innovation through agricultural research can help to alleviate poverty and improve food security by stimulating agricultural growth, improving employment opportunities, and expending food supplies.

Income growth is one of the most influential factor on the dietary improvement. Increasing the income of households with malnourished members can improve their food security in terms of improving their excess to food. Policies may involve shifting resources from large to small scale farmers, from industry to agriculture, from capital intensive to labor intensive activities. Stabilizing domestic production is a way to reduce food insecurity in a country. Investing in drainage, irrigation, pest and disease control and in general agricultural research can stabilize domestic production.

II. – Agriculture in Türkiye

Türkiye covers a total of 780,576 sq km, of which 97% is in the Anatolian Peninsula and 3% is in Europe. The population is around 56 million, 41% of whom live in rural areas and are engaged in agriculture. The rural population is less than half. Türkiye is one of the self-sufficient countries in the world.

Türkiye, being surrounded by seas and covered by rough landscape, has an ecological structure that allows for four seasons simultaneously. It has various climatic regions and an average rainfall that changes from 300 mm (12") to 2,400 mm (96") in different regions. Irrigation is considered essential in increasing and stabilizing agricultural production. Türkiye is divided into 9 agricultural regions based mainly on topographic and climatic features which are major determinants of the farming systems.

Dominant climates are the Mediterranean climate, with hot, dry summers and warm, rainy winters and the Continental climate with low rainfall, partial humidity and a great range of differences between day and night temperatures. This extreme geo-climatic diversity permits a wide range of crops to be grown under both rainfall and irrigation conditions. Some regions are suitable for multiple cropping.

Türkiye has a big potential for agricultural production. There are about 4 million agricultural enterprises utilizing 28.5 million hectares. Yet approximately 85% of these enterprises are less then 10 hectares in size and include 42% of the total agricultural area.

Agriculture has long been a significant sector in the Turkish economy. This significance stems from its high capacity for production which is attributable to the presence of a rich resource base in terms of soil and water. In addition, the different agro-ecological conditions throughout the country provide the sector with a unique production diversity.

Total land area of Türkiye is 78 million hectares of which 28.5 million hectares or 36% are cultivated. Sown areas account for 79% of this total cultivated land. Remaining 21% is left to fallow.

Since the establishment of the Turkish Republic in 1923, there has been substantial development in the agricultural sector. Total agricultural land has increased from 11.7 to 28.5 million hectares. At the same time, productivity per hectare has gone up eighth to ten times depending on the variety of agricultural products. The use of fertilizers, improved varieties of seed, chemicals, and agricultural machinery have brought about this development, which is a major result of agricultural research activities. For example, the total production of wheat has increased from 2,000,000 tons in 1920, and 3,600,000 tons in 1950, to 9,900,000 tons in 1970, and with a great increase to 19,000,000 in 1990. The production of other crops and animal production has also increased six to ten times depending on the crop type. The production of some major crops in the last 40 years is shown in *Table 1*.

At present, about 41% of the population depends for income on agriculture. While this percentage was much higher in the past, its present level is regarded as undesirable high in view of the diminishing share of this sector in the GNP. In fact this

Table 1. Production of Major Crops and Fishery (000 ton), and Number of Animals

Crops	1950	1960–1962	1970–1972	1980–1982	1990	1992
Wheat	2928	7967	11900	17000	20000	19300
Barley	1603	3383	3715	5867	7300	6900
Corn	401	969	1068	1267	2100	2100
Food legumes	319	596	615	974	2187	1913
Tobacco	79	110	168	204	228	320
Sugar beet	887	3331	5369	10221	13986	14800
Cotton	280	211	489	492	611	605
Sunflower	53	93	462	642	860	900
Potato	269	1433	2022	300	4300	4500
Fishery					385114	
Sheep (head)					40553000	
Goat (head)					10977000	
Cattle (head)					11377000	

Source: • M. Gurbuz. 1993. *Türkiye Tarimi '1993*. TMMOB Ziraat Muhendisleri Odasi. Ankara.
• SIS. 1990. *The summary of agricultural statistics*.

share has gone down from 38.3% in 1962 to about 16.2% in 1990. This sector is expected to continue transferring labor force to other sectors, mainly industry and services, in line with the higher growth targets set forth in the current development plan for these sector. Agriculture, until recently, had the major share in the total export revenue of Türkiye. This share has diminished over time as a result of the gradual transformation of the economy into an industry-based one. Nevertheless, the volume of the exported agricultural products is presently much greater than in the past. The present share of agriculture in total export revenues is about 19% *(Table 2)*.

Table 2. Foreign Trade of Agricultural Products (000 US $)

Year	1986	1987	1988	1989	1990
Export	1885604	1852539	2341398	2128222	2347028
Import		782300	499301	1041099	1318261

Source: SPO. 1992. *Main Economic Indicators*. Ankara.

Growth rates of value-added agricultural products showed variations: they averaged 2.1 %, 8.9%, and 10.8%, 11.6% respectively for the years of 1987, 1988, and 1989, 1990. Total exports from Türkiye were 2,682.8 million U.S. dollars in 1991 (SPO, 1992). Major export items were tobacco, cotton, fruits and vegetable, pulses, livestock and livestock products.

Agriculture is of particular importance for feeding the rapidly increasing population as well as for contributing to the national development efforts. It also plays a key role in supplying raw materials to the industry. In addition, it has contributed, and still does, to the evolution of the industry which supplies basic inputs for agriculture such as fertilizers, pesticides and machinery.

The relative shares of sub-sectors in the national agricultural income are as follows: crops 54.3%, animal production 35.1%, aquatic products 4.2% and forestry 6.4%.

III. – National Agricultural Research Systems (NARS) Strategies towards Food Security

The main objectives of the Turkish government in agricultural sector are: i) to modernize further and disseminate improved production techniques in order to raise productivity, yields and farmers income; ii) to maintain food requirements of a growing population; and iii) to provide agricultural export. Government is taking measures, amongst others, to strengthen agricultural research (FAO, 1990, Bayaner et al., 1993). Retained research programs include 21 programs for less developed regions, consisted of crop, livestock, irrigation/drainage, mechanization and forestry programs and 5 national programs consisted of farming systems research, erosion control/soil conservation, soil fertility, integrated pest management and residue control.

The role of agricultural sector within the Turkish economy over the last 20 years has been seen as that of supporting the drive toward industrialization. The task of agriculture to supply food and raw materials for industry was expressed in the five year development plans.

The Ministry of Agriculture and Rural Affairs (MARA) serves farmers in matters such as animal and plant breeding, home economics, and the financing of farm machinery, fertilizers, seeds, and chemicals. Policy instruments to increase the income of poor farmers implemented for food security are support price for the basic commodities, input subsidies, credit with low interest rate, irrigation projects, input supply, integrated pest management, soil rehabilitation projects and National Agricultural Research Projects. Transferring the research findings is also a major responsibility of the MARA.

NARS in Türkiye has played an important role in improving household food security in Türkiye. Türkiye has shown a significant increase in crop production since the establishment of the Turkish Republic, as a result of rapid mechanization, and the integration of high yielding varieties with improved agronomic techniques. Therefore, Turkiye has become the leading wheat and food legumes producing nation in West Asia and North Africa (WANA). This has resulted from the substantial change in agricultural structure and development in the last 40-50 years.

Agricultural development is achieved as a result of investment in agricultural research since 1928 when the first agricultural research institute was established. However, the development was slow until the 1950s. A large increase in cereal production occurred shortly after the 1950s because of i) a marked increase in the area of crop production, largely cereals, due to rapid mechanization, and ii) a more gradual and less uniform increase in production per unit area due to the introduction of improved varieties and production technologies especially fallow management and fallow replacement (Keatinge, 1993). In addition, the development and maintenance of a substantial cadre of trained scientists is a

key to the success of agricultural production in Türkiye.

In the last 40 years, Turkish agricultural development has been very substantial and profitable. Türkiye has doubled cereal production, mainly wheat and barley, since the establishment of the National Winter Cereals Project in 1969. Today, Türkiye is the 7th biggest wheat and barley producer in the world (Uzunlu and Bayaner, 1991; Braun, 1992). Türkiye achieved self-sufficiency in cereals—mainly wheat—in the late 1960s and has subsequently become a major exporting country. Türkiye has also become a world leader in export of lentils and chickpeas as a result of the fallow replacement project initiated in 1983. This enhanced crop productivity has coupled the number of sheep.

The Republic of Türkiye has recognized the danger of food insecurity and the importance of agriculture in the development of the national economy and in human feeding. Türkiye at present has sufficient food supply which is a necessary condition for food security. However, the role of NARS is to sustain and improve it. Agricultural growth and/or food crop yield increase or stabilize is the major responsibility of the NARS.

The Ministry of Agriculture has realized that it is crucial to increase farm household income for food security and currently initiated Farming Systems Research (FSR) project, although FSR has in some cases failed to serve as an interface between local level development needs and opportunities, and national agricultural development priorities policies, and strategies (Abalu, 1992). Knowing that poor consumers are poor farmers and poor farmers are also food producers with a market relatively isolated and high transport costs, FSR approach is believed to increase the farm income of the poor in a relatively short period of time.

In addition, the government of Türkiye initiated an Agricultural Extension and Applied Research Project (AEARP) aiming at upgrading and strengthening national agricultural extension systems, the link between farmers—extension service—research institutes, and developing and disseminating appropriate improved technology to lift farmers productivity and income.

Lately, a new Agricultural Research Project (ARP) has been initiated aiming at strengthening the agricultural research capacity of the country with particular emphasis to research providing significant benefits to the less developed regions.

Southeastern Anatolia Project (GAP), being constructed on the basins of Euphrates and Tigris rivers, is the most important project of the Republic of Türkiye. There are 13 irrigation and hydro-electrical power projects within the GAP. After realization of these projects, 1.7 million hectares of land will be brought under irrigation. GAP is expected to be completed by 2001. Beginning from 1991, 150,000 hectares of land has been brought under irrigation each year. GAP area is a virgin area from the agricultural point of view. After realization of irrigation systems and due to the application of technological innovations, this area is going to be one of the most important ones for growing industrial crops in Türkiye (Anonymous, 1989), and there will be a major break through in agricultural production.

Development and technological progress of agriculture are important sources of economic growth which is itself a major factor to food security. Increasing and stabilizing yield per unit land with high quality is one of the major objectives of the Turkish NARS. The scope for expending food production through horizontal expansion of cultivated area is limited. Therefore, efforts to increase food production would need to focus on raising yield per hectare through the use of improved technology. Introduction of suitable crop rotations, use of improved seeds, fertilizer, pesticides, soil and water conservation measures and improved drainage facilities could help to increase yield.

Strategies of the Government of Türkiye have emphasized improving agricultural productivity through strengthening research and extension services, encouraging the use of improved seeds and agricultural inputs, expanding the irrigated area and improving irrigation efficiency.

The strategies of NARS to stabilize and also increase agricultural production and thereby to increase household income is to:

– further develop Fallow Reduction Project (FRP) in the future with the perspective of reducing risk of degradation of existing land resources;

– develop modern varieties (HYV) with wide adaptation, resistance to cold, drought, lodging and diseases, and of high quality;

– improve the production practices-soil moisture conservation, seedbed preparation, seeding, fertilizer use weed control, rotation, etc;

– improve management and conservation of rich resources in fishery production;

– encourage further livestock production, import exotic livestock breeds, increase progeny, the quality and yield of important products such as meat, wool, silk, and eggs;

– increase the marketing possibilities by high-quality varieties that can satisfy the requirements of international marketing.

IV. – Agricultural Research Activities

In Türkiye, agricultural research started during the first few years of the Republic for the purpose of deriving maximum benefit from Türkiye's natural agricultural potential. Agricultural research has played an important role in the improvements achieved in agricultural production since that time. Particular advances have been the transfer of high yielding genotypes suitable for various agro-ecologies into production and the dissemination of improved production techniques. These have had important effects in bringing about agricultural development. At present, research activities are carried out at national and regional levels by 66 research institutes. Importance is attached to the exchange of information and materials with foreign research organizations and developing relations with them. Furthermore, foreign research findings and applications are monitored and evaluated; those that are tested and found applicable under the conditions prevailing in Türkiye are developed and transferred to farmers.

Agricultural research activities are regarded as a public good by the government and are thus performed by government institutes; a considerable part of the research is carried out by the Ministry of Agriculture and Rural Affairs, the Ministry of Forestry, and Universities. In addition, other public sector agricultural research is performed by the state enterprises of tea (Caykur), tobacco (Tekel), and sugar beet (Seker).

Scientific and Technical Research Organization of Türkiye (TUBITAK) supports the research activities on various fields. Agricultural faculties and departments of economics of Middle East Technical and Hacettepe Universities also undertake some basic research activities on their fields. The Association of Atomic Energy and Nuclear Research carries out studies on plant nutrition and breeding, soil fertility, food storage and animal health by utilizing nuclear techniques.

Apart from these state institutes, several private seed companies conduct adaptation trial on some important plant varieties such as: vegetables, sunflower, soybean, millet, and safflower. In addition, research on agronomy and plant protection is also conducted.

Two General Directorates of MARA deal with research activities:

– The General Directorate of Agricultural Research (GDAR): There are 4 central, 8 regional, and 43 commodity research institutes under this General Directorate. These institutes work on field crops, horticultural crops, plant protection, livestock, aquaculture, animal health, and food and feed technology. 780 agriculture engineers, 210 veterinary surgeons, 30 chemists, 15 biologists, seven aquaculture scientists, and seven electrical engineers are working in GDAR.

– The General Directorate of Rural Services (GDRS): There are 10 regional—and 1 Soil and Fertility—research institutes under this General Directorate. Research activities are carried out on soil fertility, soil rehabilitation, and water use. GDRS also serves farmers routine soil analyses.

Regarding plant research activities, wild species and varieties of plants collected and preserved, and characterization studies are carried out. Findings are presented to researchers for the establishment of genetic stocks and for preserving the existing plant genetic resources. Türkiye has numerous micro-gene centers as its position is at the intersection of the Mediterranean coastline and Near East gene centers. Plant research activity is mainly concerned with those plant varieties which have economic significance. Emphasis is placed on agronomy and quality studies, and production of information on breeding and growing techniques oriented to the development of superior genotypes.

In livestock research, emphasis is placed on increasing progeny, and the quality and yield of important products such as meat, milk, wool, silk and eggs. In order to reach this objective, research regarding breeding and rearing techniques is carried out, and efforts are made to adapt superior exotic genotypes to conditions prevailing in Türkiye and to extend their use. In the field of fisheries, research activities include fish breeding in marine and inland water conditions, stock assessment, fishing and processing techniques. The fishery policy has recognized the importance of aquaculture in increasing fisheries production, and provided incentives for encouragement.

Horticultural production development activities are carried out in the fields of fruit growing, viticulture and vegetable growing; new fruit orchards and vineyards are established and mature project establishments are managed and controlled. Every year there is an annual program for the grafting of wild trees such as pistachio, and production of wine,

fruit, olive and citrus seedling. Infrastructure of production organizations is also being developed, and numerous high and low plastic tunnels are being established for the production of seedlings.

Economic and Marketing research have been given importance recently and will be strengthened with the establishment of an Economic Research Institute.

V. – Consumption Pattern in Türkiye

Türkiye, as a developing country, produces 20 million tons of wheat, of which some 12 million is consumed within the country. Turkish nation has one of the highest per capita consumptions of wheat production in the world (Uzunlu and Bayaner, 1991). Per capita consumption of agricultural products are given in *Table 3*. A research conducted by Central Research Institute for Field Crops in the Eastern Margin of Central Anatolia, one of the less developed region in Türkiye, showed that the minimum average intake per capita is 3,300 calories, (Bayaner et al. 1993). Here it can be concluded that at present Türkiye is a self-sufficient and a food-secure country and is likely to stay so in the near future.

Table 3. Per Capita Consumption of Agricultural Products (kg/year)

	1983	1989
Cereals		
Wheat	200.0	200.0
Rice	3.6	4.5
Other Cereals	14.8	16.6
Pulses	7.9	8.0
Other Field Crops	134.5	136.8
Fruit, Vegetables	236.8	239.8
Citrus Fruits	18.4	18.2
Grapes	25.1	25.3
Other Fruits	61.0	60.5
Vegetables	132.0	135.8
Total Meat	21.8	24.5
Milk	123.4	143.6
Eggs	5.4	7.0
Fish	8.8	11.6

Source: SPO. 1989. *Fifth Five Year Plan*.

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