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Review Article

New agricultural production planning

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Abstract

The concept of new has a different meaning than the old one, which has never been tried before. Every production actually contains the new. Agricultural production is the whole of the activities that human beings do to obtain the plant-based foods and animal-based foods they need. The change in phenology due to climate change also changes the dates of combating diseases and pests, and in some years, the harvest dates. Due to climate change, excessive precipitation, hail, extreme heat, changing life cycles of diseases and pests adversely affect agricultural production and production costs. Furthermore the disruptions experienced in the access of human beings to food due to the impact of the COVID-19 epidemic have led to the need for restructuring of the agricultural sector. Restructuring can be achieved by re-planning agricultural production, taking into account all the factors affecting the agricultural sector. This study aimed to provide suggestions on what should be done for the planning of agricultural production in order to ensure the right of human beings to access food. The work that can be done for the stability of the supply and prices of agricultural products depends on many factors. It is necessary for the sustainability of agricultural production to protect the world's agricultural lands and natural resources and to make plans so that the life cycles of all living things that have changed due to climate change will less affect the world agricultural production.

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Introduction

Nutrition is one of the most important basic needs of all living creatures (Ersoy, 2020). While agricultural areas meet the nutritional needs of the city, they are also extremely important areas for ensuring the sustainability of the traditional-rural life of the city. Agricultural belt plans, which are not yet implemented in conservation planning in some countries of the world, are one of the important tools that can be used to protect agricultural areas and natural resources around cities. Agricultural belt planning can be made for the sustainability of rural-agricultural landscapes by examining the change processes on the fertile agricultural lands on the environments of the cities in different dimensions. Rural agricultural landscapes, which are production areas that are important for biodiversity, are important areas for cities to provide biotic resources and ecosystem functions. It is expected to contribute to climate control and carbon sequestration at the urban scale, if planned in connection with agricultural belts, natural areas and important wetlands and rivers of cities (Taşkan and Atik, 2020).

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The vacant agricultural lands in rural areas lead to an imbalance of supply and demand for the foodstuffs needed by consumers, resulting in the problem of food inflation. If migration to the city cannot be stopped, it will become even more difficult to ensure food supply security (Avşaroğlu and Arısoy, 2021). The decrease in the population living in rural areas has led to the decline of social services in the villages and the desire of the people living in the village to move to the city. With the improvement of the infrastructure and social opportunities in the villages, the increase in the income to be obtained from agricultural production can enable the young population to turn to agriculture again. Directing the young and dynamic workforce to agriculture can be a solution to the youth unemployment problem (Bal, 2018).

Depending on the globalization policies, making cities safer, healthier, more livable, more equitable, sustainability and efficient use of scarce resources, and therefore environmental awareness has become an international development policy (Meydan, 2013). The land on which people live and continue their economic activities is a very important natural resource for human life. At this point, "land use" is of great importance. Land use, in general, can be defined as the current determination of the land, its classification in terms of value and the planning of the way of use (Gözenç, 1980; Karabacak and Özçağlar, 2013).

Insufficient land size of agricultural enterprises increases transportation losses and costs in enterprises. As a result, farmers cannot create capital accumulation. Due to the increase in the costs of agricultural crops, producers are in a disadvantageous position, especially in foreign trade (Küsek, 2014). Total fixed capital investments in agriculture are mainly for agricultural infrastructure activities (irrigation canals, land consolidation, improvement work and agricultural R&D). These activities directly or indirectly increase productivity in agricultural production. This situation increases both agricultural production and the share of agriculture in GDP (Gross Domestic Product). For this reason, a good planning of fixed capital investments to be made in agriculture will increase agricultural production. In this regard, the private sector should be encouraged and the fixed capital investments of the private sector in agriculture should be increased (Terin et al., 2013). Agricultural producers whose capital and labor are not wasted may have the capital and motivation to produce more in the future. More production by farmers will facilitate access to accessible healthy food (Ersoy, 2020).

Along with urbanization, changes occur in many economic, social, administrative, political, environmental, technical and scientific fields. Nowadays land use may create many urban and environmental problems and may lead to rapid destruction of scarce resources, pollution of the environment, new costs, and social and spatial differentiation. However, environmental problems can be minimized and even prevented when legal, administrative and social infrastructure is provided for accurate and rational planning (Meydan, 2013). Agricultural lands should not be allowed to build housing. Degraded lands should be restored (Gökkür, 2020).

In the areas where agricultural cultivation is carried out, the local architecture should be preserved and renewed in the settlements, and the construction of new buildings should be in harmony with the traditional architecture. Environmental arrangements should be planned in harmony with the local architecture. These regulations, which will help agricultural producers to love the regions where they produce, will reinforce their sense of belonging and will make positive contributions to sustainability in agricultural production.

It is no longer possible to physically increase agricultural lands today. For this reason, ensuring a more rational and effective use of the resources is one of the basic conditions to increase productivity in agriculture (Kayabaşı, 2020). A strategic management model can be created by bringing together all the studies on the protection of agricultural lands with a holistic approach. The agricultural sector is actually a holistic secret brand consisting of many brands (Gökkür, 2020). Considering from the point of view of the country's economy, agricultural production planning is important in terms of meeting the nutritional needs of citizens living in the country with the efficient use of land and resources, and foreign exchange input to be obtained from agricultural product exports (Ersoy, 2020). In regions whose exports depend on a small number of agricultural crops, it may be necessary to turn to alternative crops for export. Taking into account the climatic parameters, crops suitable for geographical conditions should be grown. Considering the increasing temperatures due to climate change, it is necessary to start to turn to agricultural crops with low chilling requirements

(Gökkür, 2020). Whether it is to prevent famines or to increase agricultural profitability, it is necessity to make planning in agricultural production (Ersoy, 2020).

Objectives

Changes in the life cycles of all living things due to climate change in recent years threaten the increase in agricultural production. The main purpose of this study is to identify the problems that threaten the sustainability of agricultural production and to offer solutions to the problems in agricultural production planning.

What precautions should be taken against risks and uncertainties in agricultural production?

In the planning of agricultural areas for agricultural production, many factors such as water resources, climate, soil structure, topography, selection of suitable plants for growing and ease of access to energy should be considered. Sustainability is a concept that came together with many factors. There are many factors that threaten sustainability in agricultural production. Factors threatening sustainability in agricultural production are shown in Figure 1.

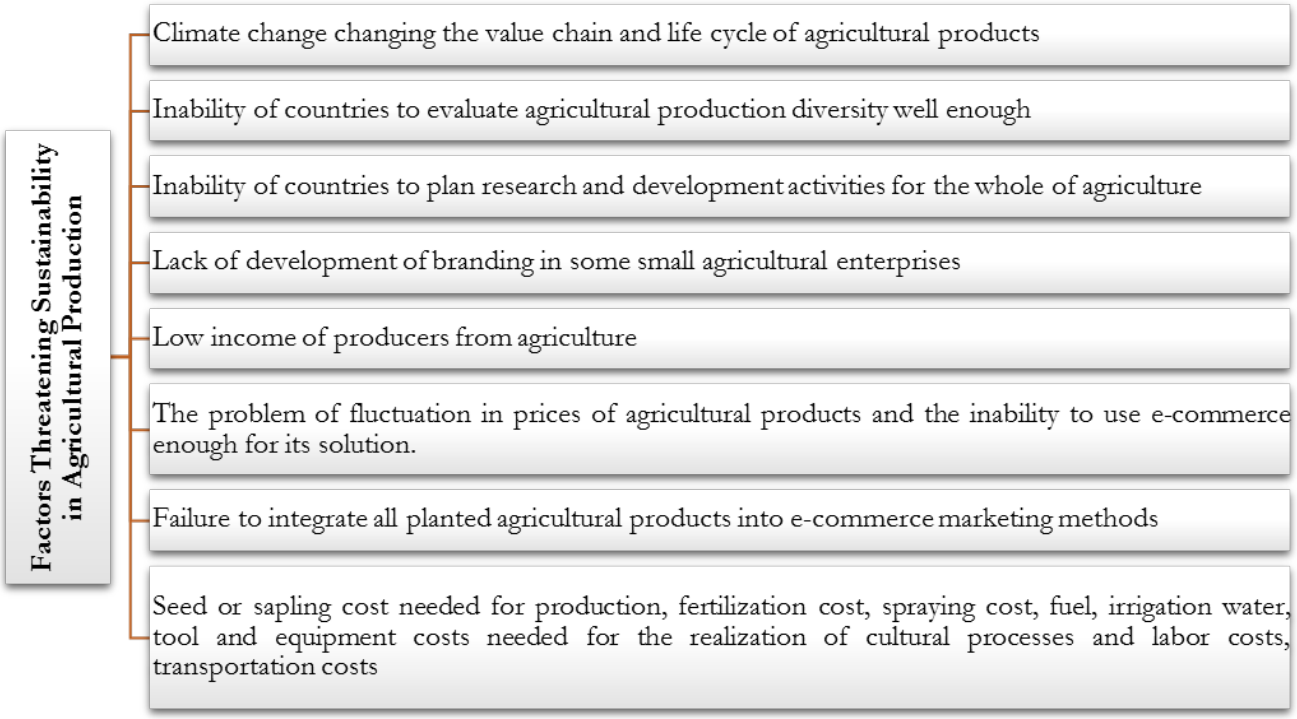

Figure 1. Factors threatening sustainability in agricultural production

In some countries, input costs in agriculture are very high. Farmers spend a significant part of their income from the products they grow on production costs such as seeds, fertilizers, pesticides, irrigation, electricity, diesel, buckets for harvesting and crates. Agricultural supports should be increased when irrigation fees, diesel prices, fertilizer and seed prices increase with the legal regulations to be created. In countries where agricultural subsidies are insufficient, diesel and fertilizer subsidies may be revised to provide more support to those who produce more. In addition to these supports, supports can be given under the name of welfare improvement support for agricultural crops with high growing costs.

Bozdemir et al. (2019) declare that the increase in the world population over the years and the increase in the necessity of efficient use of agricultural resources, the development of agricultural mechanization and production techniques; it has caused the preferences of the producers in the production pattern to change and the product demands of the consumers to differ. All these developments in agriculture have led to an increase in demand for the production and consumption of products that are important in the food and industrial industry. The business decisions, which are shaped according to irrigation facilities, climatic conditions, cyclical fluctuations, input costs, marketing opportunities, technology and workforce use, also directly affect the principles of the production process. Products that are

advantageous for agricultural business have expanded in parallel with the increase in demand in both the food and industrial industries. The experiences of the business who carry out these productions from the planting to the harvest of the products shape both the sustainability of the production and the expectations for the sector.

The way to feed the rapidly increasing population is to increase plant production. Productivity in crop production is under the influence of many factors such as social, environmental and economic factors. Provided that all these factors are found in a balanced way, an increase in agricultural production can be achieved. Likewise, determining the factors limiting production will be effective in putting the solution proposals correctly (Tuğay, 2012). Agricultural enterprises continue their activities under risk conditions in the production-marketing process. Businesses are struggling against the risks posed by actors such as nature and the market. Risks arising from nature cause variability in the amount of production. Among the other risk factors related to production, the most important ones are climatic conditions (Şahin and Miran, 2010).

Changes in the economies of countries, changes in input costs, changes in product prices, inadequacy of agricultural tools and machinery, changes in crop yields, changes in land prices, changes in climatic conditions, frost events, excessive precipitation, insufficient precipitation, low yield due to diseases, low productivity due to pests, health problems of workers, problems in family relations, inadequacy of family labor, difficulties in finding foreign labor, lack of contracted production, theft, damage to the product due to fire, damage to the product due to flood, earthquakes changing the shape of the land, failure to keep business records are among the important sources of risk (Akçaöz et al., 2006a).

There are risks and uncertainties arising from production, market, financing, technology and climate conditions in agricultural production. Factors such as the lack of precipitation at the appropriate time for the product, the increase in product prices after the harvest, the lack of sufficient workforce at the required time, the variability in the policies of the governments reveal the risk and uncertainty. All these factors cause income fluctuation in agriculture. In agriculture, if the level of risk faced at the level of production, business, region or sector can be measured, risk strategies can be suggested based on the degree of risk measured and the size of the amount subject to risk (Karahan, 2002; Akçaöz et al., 2006a). The situation of uncertainty in agricultural production causes stress on farmers and affects the attitudes and behaviors of farmers during the decision-making phase. If farmers can recognize and interpret their risk behavior, they will be able to make better decisions (Ceyhan et al., 1997; Bauer and Bushe, 1993; Akçaöz et al., 2006a). Farmers will increase the income of the enterprises if they carry out plant production and animal production together. Thus, risk factors will be dispersed with different production branches. In order to reduce costs in animal production and for a profitable production, the farmer may need to produce his own forage crops. Supporting animal production can reduce imports to some extent (Bal, 2018).

Measures

Measures to be taken by farmers against risk factors affecting agricultural activities are as follows (Akçaöz et al., 2006a):

- Fighting pests and diseases
- To have information about the market where the agricultural products will be sold
- Capital expenditure planning
- Managed by experts
- Product liability insurance
- Financial record keeping
- The priority in capital management is to enlarge the land
- To include more than one type in agricultural production
- Selling the agricultural crops produced in different periods

Some of the agricultural, social, economic and environmental measures regarding climate change are as follows (Republic of Türkiye Ministry of Agriculture and Forestry Directorate General for European Union and Foreign Relations, Department of Monitoring and Evaluation, 2023):

- Developing systems that support climate-resistant and sustainable food production
- Transforming food systems on soil erosion, soil salinity, water scarcity and natural resource management in agriculture
- Preparation of basin-scale sectoral water allocation plans in which optimum plant pattern and irrigation planning (agriculture according to water supply) are determined in order to obtain maximum income with minimum irrigation water use in the agricultural sector
- Application of basin-scale drought and flood management plans on the basis of risk approach
- Zero waste approach in agricultural activities
- Modern irrigation systems investments, spreading of water efficiency practices in the industry
- Evaluation of the reuse of drainage waters in agriculture
- Protection of forest areas close to developing cities
- Increasing renewable energy sources in order to prevent the increase of carbon emissions
- Development and spreading of precision agriculture application technologies using renewable energy sources
- Development of automation and artificial intelligence systems to control losses in irrigation systems and to ensure water efficiency
- Increasing productivity in agricultural production

Farmers may choose to cooperative in order to determine input prices such as fertilizers, seeds, fuel and pesticides, and fluctuations in product sales prices. Thanks to an effective cooperative, they will have the opportunity to obtain the agricultural inputs required for production at more affordable prices and to process the products and market them at higher prices. Thus, they will be able to both reduce the fluctuation in prices and facilitate the supply of inputs (Bal, 2018). Agricultural cooperatives and professional organization related to all stages of agricultural activities (production, processing and marketing) should be encouraged. Cooperatives should be made more independent in terms of management and financing. The role of professional organizations in the decision-making mechanism regarding agricultural policies should be increased. The contribution of cooperatives, professional organizations, local administrations and the private sector should be increased in the fulfillment of services such as agricultural input supply, agricultural credit, marketing services, research, publication and training provided by public institutions (Azmak, 2012). As a result of uncontrollable natural disasters and diseases, the income of farmers varies from year to year (Akçaöz et al., 2006b). For the continuity of agricultural production, agricultural insurance, which is one of the risk management strategies, is required to ensure the stability of product prices and farmer incomes (Çetin, 2003; Akçaöz et al., 2006b). The high insurance premiums in the agricultural sector cause farmers, who are potential insurance customers, to give up taking out insurance. With the correct evaluation of the damage statistics in agricultural production, the amount of premium that farmers must pay will be determined correctly. The involvement of experts in the damage determination phase will enable farmers to trust insurance companies (Akçaöz et al., 2006b). The factors that cause the insecurity of producers who do not have agricultural insurance should be eliminated, and the number of insured farmers should be increased. Growers should be informed about agricultural risks, risk management and agricultural insurance (Bal, 2018).

Employment is an important macroeconomic variable that closely affects the economic growth of a country and the living standards of the society. In addition, employment also allows countries to obtain more tax revenue. There are many macroeconomic variables that affect employment. Among these, the most prominent ones today are real wages and labor productivity (Köse & Avcı, 2023). In order to ensure the continuity of agricultural production and to use resources efficiently and effectively, it is necessary to build expectations for the future today. For this, there is a need for workforce, which is an important production input in rural areas, and workforce planning. Individuals who carry out agricultural activities want their children to continue their education and to be employed in other business lines. The potential population's abandonment of agricultural activities will have a negative impact on the agricultural sector for the future. For this reason, it is necessary to make plans for employment in agricultural activities, to improve working

conditions, to plan the education of the second generation to encourage agricultural activities and to raise awareness of families (Bozdemir et al., 2019). New studies should be carried out to increase the working age population (working age population in the 15-64 age group) employed in the agricultural sector (Gökkür, 2020). In addition, contract farming should be encouraged by creating a legal infrastructure (Azmak, 2012).

Producers should be informed about the agricultural products grown, the use of modern irrigation techniques, fertilization applications based on analysis, the fight against diseases and pests, the use of modern tools and equipment and new varieties. For this purpose, applied extension studies should be made more effective and widespread. It is necessary to reorganize and increase the support to be given to the enterprises in providing production inputs (Oral and Akpınar, 2016). Bureaucratic procedures in agricultural credits should be simplified and credits should be provided on time, adequately and with the low interest. Agricultural credits should be used to support the formation of optimum agricultural enterprises (Azmak, 2012). Measures should be taken to prevent further fragmentation of small-scale enterprises, and non-agricultural use of existing agricultural lands should be prevented. Producers should be encouraged to establish their own organizations. The majority of the problems in the production and marketing stages of agricultural producers are the problems arising from being unorganized and unable to act together. Agricultural production should be started in a planned and programmed manner and an inventory of the grown products should be made (Oral and Akpınar, 2016).

The fact that the agricultural lands remain stable with the increasing population makes it necessary to make maximum use of the agricultural lands. Since it is not possible to increase agricultural lands, the action to be taken is to increase the yield obtained from the unit area. This increase will be possible by abandoning traditional agriculture and passing to modern agricultural techniques. Mechanization practices are at the forefront of modern agricultural techniques (Küsek, 2014). A holistic approach in agricultural production and development, compliance with international commitments, sustainability, sensitivity to human health and the environment are among the important principles of agricultural policies (Yalçınkaya et al., 2006). The widespread use of renewable energy sources in the agricultural sector will benefit both socio-economic developments and the understanding of sustainable agriculture. With the increase in the use of many renewable energy sources such as Solar Energy Water Pumping Systems, Solar Spraying Machines, Geothermal Greenhouse Heating Systems in agricultural areas, the use of green energy in agriculture may become a habit for producers (Taşkın & Vardar, 2016). The application of modern agricultural techniques and a good production planning will increase agricultural production (Tuğay, 2012).

Agricultural extension, also called rural extension. Agricultural extension is a process with an educational content that aims to increase the income levels of all disadvantaged people living in rural areas, to gain knowledge and technology transfer through education, and to develop their decision-making and problem-solving skills. Not every farmer can record all activities at every stage of production in the database. Those who will transfer new technologies and new knowledge to people who make a living from agriculture should go through a good education in the relevant fields. It should be aimed to ensure the applicability and sustainability of innovation by ensuring the participation of local people in innovative studies and projects to be carried out in rural areas. Projects without public participation have no chance of success. There is a great need for publishers in the process of delivering the produced information and technology to target groups, increasing its applicability and adoption (Kayabaşı, 2020).

It is necessary for the countries of the world to have the appropriate tractor park and agricultural machinery required for the geographical regions and to use the agricultural machinery effectively in agricultural production. In regions that do not have economic adequacy, farmers can be offered the opportunity to use agricultural machinery jointly. In addition, training activities for the use of tractors and agricultural tools and machinery will positively affect productivity in agricultural production (Altuntaş, 2016).

Agricultural Production Plan

Planning is a process in which more than one discipline creates unity and many factors are considered holistically. Planning in agriculture should not be prepared with only production and marketing in mind. Ersoy (2020), state that

the destruction of food materials is also a serious problem, as it is produced in excessive amounts and cannot provide economic benefits. The labor, capital and land spent on spoiled products go to waste when they could have been spent on another product. On the other hand, in addition to the economic damage caused to the farmers by the products that are produced and destroyed due to the lack of planning, there is also a harm to the consumer as an increase in food inflation. In a world where everything continues in a balance, the problem of nutrition in humanity will be able to be solved by producing and consuming in a balanced way. This balance will enable the farmer to maintain his life economically, as well as enable the consumers to reach the crop as much as they need.

In the planning process of agricultural lands, the natural environmental conditions in which the agricultural areas are located were determined and it should be emphasized to what extent these natural environmental conditions affect agricultural activities. While developing planning proposals, internal and external factors should be considered together and especially weak or missing points should be focused on (Taş, 2011). The efficient use of limited resources is also important in terms of ensuring sustainability. Therefore, the importance of planning in sustainability is great. As in other sectors, planning in the agricultural sector and making production decisions within the framework of planning can significantly affect productivity and profitability of enterprises (Güler & Saner, 2021).

Agricultural lands, the formation of which took thousands of years, is the only resource that cannot be produced and is almost impossible to renew. For the development of countries and for raising the living standards of people, there is an obligation to use and manage agricultural lands in a sustainable way. Sustainability of soils is possible by examining and monitoring soil resources adequately and defining the characteristics of these areas in the best way (Özyazıcı et al., 2016). Excessive use of fertilizers and chemicals causes agricultural lands to become unproductive on the long view (Stoate et al., 2009: 26; Taş, 2011). Knowing the amount of nutrients present in the soil before fertilizing in agricultural areas is very important for a correct and balanced fertilizer application, as well as increasing the efficiency of use of plant nutrients, reducing environmental risks and economic losses (Kılıç and Korkmaz, 2012).

Countries need new technological inputs as their level of development increases. The data obtained as a result of the spread of these new technologies will contribute to the planning of agricultural systems by arranging the production systems according to the plant groups grown in the regions. Determining the adequacy of the soils in terms of the examined properties will be an important source of information for fertilizer production planning and the preparation of the type and amount of fertilizers needed according to the region (Özyazıcı et al., 2016). In the planning proposals to be developed for agricultural areas, it is important to protect the soil for sustainability (Stoate et al., 2009: 26; Taş, 2011). Producers should be made aware of the use of agricultural inputs such as fertilizers, pesticides, hormones, agricultural tools and machinery in a way that will provide the highest economic benefit. Mobile, fertilizer and soil analysis laboratories should be established to increase efficiency in fertilizer use (Azmak, 2012). It is important that the productivity and quality elements of soil resources, which are the primary values for the realization of the agricultural information system throughout the world, are constantly monitored by the applied technology. In addition, the soil distribution maps to be obtained as a result of such studies will also serve many scientific studies made by the agricultural organizations, research institutes and universities interested in the subject (Özyazıcı et al., 2016).

In the planning of agricultural areas, it is important to ensure sustainability by using resources such as energy and water in a controlled manner and by making optimum use of them (Lu and Daniel, 2009: 2590; Taş, 2011). One of the important conditions to ensure the normal development of the plant is the availability of sufficient moisture in the root zone during the growing season. The first source of this moisture is natural precipitation. The amount and distribution of precipitation falling during the plant growing season in humid regions is generally at a level to meet the plant water needs. However, precipitation falling during the plant growing season in arid and semi-arid climatic regions is insufficient in terms of both quantity and distribution and cannot meet the plant water needs. Therefore, the missing moisture in the root zone of the plant is complemented by irrigation water. Therefore, irrigation is very important for crop production (Gürgülü and Ul, 2017). The most important factor shaping agricultural production and determining the product pattern is irrigation opportunities in agriculture. In irrigated soil, both productivity increases and producers

can grow second crops. The development and widespread use of drought-resistant seeds and the application of techniques to increase water efficiency can increase both crop productivity and the income of the producer. In this context, agricultural research and development studies should be increased and supported (Bal, 2018). Furthermore countries that are not rich in water resources have to use this limited resource in a planned and balanced way, especially in the agricultural sector and in other areas of use. Countries should search for ways to use household and industrial wastewater and drainage water in agriculture (Aksoy et al., 2014). In this context, models for the controlled use of natural environmental elements in economic growth and development have also been improved (Lu and Daniel, 2009: 2590; Taş, 2011). For the management and planning of water resources, supervision of irrigation activities, special pricing for the operator according to the volume of water used, calculating the water need according to the size of the land will contribute to the protection of water resources (Bozdemir et al., 2019).

In recent years, variety promotion and management has changed considerably in the world. Increasing competition in the fruit industry makes it difficult for new varieties to capture and maintain their potential value. Knowing advances in fruit breeding, breeder's rights, trademarks and how they shape the fruit industry is important for sustainable fruit growing. In an ever-growing industry, there are many factors to consider for new varieties to be successful. It is vital to understand the needs of the industry and what consumers want, and to provide a balance between the two. In order for new varieties to succeed in entering the market, they must have superiority in terms of social, economic and ecological aspects. At this point, global management and branding are inevitable in the management of new varieties. For the success of new varieties, an effective marketing campaign, very strong cooperation and support are needed. Large production areas with large manufacturers, wholesalers and marketers have a great advantage because they increase the chance of success. Therefore, fruit breeding programs must quickly adapt to effective and efficient commercialization plans, taking into account global problems. It is thought that it can be beneficial in balancing potential risks by increasing the efficiency and awareness in fruit breeding programs (Atay & Atay, 2018).

Optimum irrigation is of great importance for sustainable agriculture. In areas without drainage, water and soil erosion due to over-irrigation is a major problem. This will lead to an increase in diseases in the root zone of the plant, a decrease in yield, salinization of the soil, and the consumption of the most important natural resources of the world such as soil and water. Activities to protect our lands against water erosion and soil erosion must be included in agricultural production planning activities. In order to protect soil and water resources, drainage systems should be constructed for lands that do not have drainage. Planning of water resources is the key to success in agricultural production. Activities for the protection of underground water resources, efforts to prevent the pollution of our water resources by excessive fertilization and spraying, studies to determine plant water consumption and prepare appropriate irrigation programs will serve sustainability in agricultural production. Some of the important factors affecting plant water consumption are characteristics of plants varieties, climate characteristics, soil structure, water requirement according to the development period of the plant, topography, sunshine duration, wind, humidity. It is important to plan agricultural production according to the water source. In the production of agricultural crops, plans should be made to achieve maximum efficiency with optimum irrigation. For varieties belonging to fruit species in the fruit growing sector; It can be analyzed how many liters of water is needed per 100 grams of fruit. For this reason, it should not be ignored how much water is in the soil. The soil structure is difficult to cultivate in areas with coarse gravel. In these areas, especially in arid regions, some fruit types can be grown. In places where the temperature difference between day and night is high, the cooling of the stones at night will reduce the plant water need to some extent. In the planning of agricultural areas, the lands where irrigated farming can be done, the lands where dryland farming can be done and the products to be grown should be determined. Agricultural production areas can be planned by classifying them as agricultural products with high economic returns, agricultural products with high productivity, and agricultural products with strategic importance. Crops with high plant water consumption can be grown in places where underground and surface water resources are abundant. In some surface water resources, precipitation falls in a small amount in spring and the flow rate of water decreases. The products to be grown in agricultural lands should be planned according to the condition of water

resources, with respect to the distance of access to water and in accordance with plant water consumption. In addition agricultural areas where the least energy can be used in a unit area and maximum production can be made with the least water should be determined by using geographic information systems. In order to protect underground water resources, it is necessary to increase the frequency of observation wells and to follow them easily with new technologies and to make new legal regulations against adverse situations that may be encountered.

Decreased water resources must be taken into account in irrigation of fruit trees. Drip irrigation should be preferred instead of flood and furrow irrigation systems, which are inconvenient for fruits. Giving the water with fertilizer to the plant with drip irrigation provides a great advantage in terms of both water and fertilizer. For this reason, the conditions of fertigation in fruit growing should be determined on the basis of species and variety, taking into account the rootstock and soil, and irrigation and fertilization should be done more profitably (Köksal et al., 2010).

Fruit breeders must analyze the main issues affecting current fruit production, marketing and consumption very well. The importance of genetic diversity in coping with the challenges of climate change and in the fight against new or existing diseases and pests has become absolutely indisputable. For this reason, breeders should consider many issues such as environmental pollution, sustainable agriculture, biodiversity and global warming when planning their work (Atay & Atay, 2018).

Data on climate parameters such as temperature, humidity, precipitation, evaporation amount may vary in different regions of the same district. The connections of digital agricultural technologies with meteorology stations are important in order to be able to make disease, pest and yield estimation evaluations with accurate information. If the amount of evaporation increases, the yield and the fruit sizes will decrease. In order to determine the irrigation schedule more accurately, the number of meteorological stations may be increased in some regions (Gökkür & Arda, 2022).

One of the important problems of fruit growing in some parts of the world is the deficiencies in the post-harvest processing of fruits. Scientific studies are also needed to improve storage conditions (Köksal et al., 2010). The fact that agricultural areas have post-harvest cold storage and access roads to factories will reduce production costs, which will positively affect producer and consumer welfare.

Plant variety rights and activities to protect them are still not fully formed in many countries. Strengthening breeder rights on the basis of species and adapting them to innovative strategies is very important especially for countries with heterogeneous crop production. In addition, the development of new marketing networks as an alternative to the existing marketing strategy can help expand the breeding and trade of new varieties. Legal counseling is absolutely needed in order to counter possible violations of rights (Atay & Atay, 2018).

One of the most effective and most important factors in determining the market value of fruit is quality. For this reason, fruit producers have focused on practices to increase the amount of quality, marketable fruit along with yield. Cultural practices, soil and climatic events after planting can affect fruit quality. However, the most important factor affecting fruit quality is rootstock. In addition, the effects of dwarf rootstocks on productivity are quite high. Dwarf rootstocks set more fruit than strongly growing rootstocks (Özongun, 2011, Öztürk et al., 2013; Javaid et al., 2017; Bolat & İkinci, 2019b).

Dwarf fruit cultivation has many advantages for the producer. These advantages can be itemized as follows (Öztürk, 2008; Öztürk et al., 2013):

- More products are taken from the unit area
- Fruit trees give fruit at an early age
- Disease and pest control is controlled more effectively
- It is easier to apply the desired training system
- Investment costs return in the first years
- Every year and regular yield is obtained
- New species and varieties that can adapt to changing conditions and market demands can be grown

- Due to the fact that cultural operations such as pruning and harvesting can be done from the ground, production costs are reduced and labor costs are saved.

Thanks to the use of rootstock, a fruit species or fruit variety can be grown in large areas in the world. However, it is necessary to use the most suitable variety/rootstock combinations in order to ensure optimal tree growth in fruit plantations and to obtain high yields and quality products. There is no single rootstock that can meet all the needs in any fruit species or variety. Today, due to the increase in abiotic and biotic stress-related problems caused by global climate change, expectations about rootstocks are rising. In order to solve these increasingly complex problems, there is a need to develop new rootstock breeding strategies (Bolat & İkinci, 2019a).

Input costs and expenses incurred for production in agricultural production are of great importance in terms of profitability and sustainability of activities. For this reason, costs need to be brought under control and made manageable. In particular, the target costing method, which is an effective management tool in cost control, is also important for businesses that carry out agricultural activities. In order to apply the target costing method, it is necessary to determine a target profit level for the enterprise and accordingly, the target costing must be determined. For this, first of all, production inputs should be planned and then workforce planning should be done. Qualified personnel should be employed in matters that require expertise while employing labor force. At the same time, in order to provide labor economy, application areas of agricultural production enterprises should be planned and unnecessary labor movements should be avoided. Another important element of the target costing approach is the accurate estimation of the market share and sales volumes and the planning and realization of production accordingly. Accurate estimation of the sales volume will prevent unnecessary production activities and the excess costs that will arise due to unnecessary production will be avoided. For this, first of all, a good market research should be done. Considering all these issues, the concept of target profit should be at the top of the planning activities to be carried out by the enterprises. Considering the variability of market conditions for agricultural products, production should be carried out according to the different demand levels that these conditions will bring. It is necessary to monitor and control the costs in order to reduce the costs, increase the agricultural income and ultimately convert them into agricultural investments (Çetin and Bahşi, 2019).

Countries should make medium and long-term agricultural policy plans in livestock investments, as in all agricultural infrastructure. When it comes to planning, it is necessary to make not only management planning, but also production planning. Production planning is one of the issues that should be given special importance to managers, as it will determine from the beginning which type of livestock will be supported in which region of the country (Şahin and Karadağ Gürsoy, 2016). With the planning model to be created, enterprises engaged in livestock production can optimally determine how much land the enterprise can use to produce which products and the amount of roughage and concentrate feed to be purchased within the framework of the current number of animals and other constraints (family labor, total land, barn capacity and capital). However, it is known that some producers produce and sell forage crops on their lands and generate income from this activity. For this reason, the model can be rearranged in order to evaluate the entire existing land in the most profitable way and to determine the optimum number of animals (Güler & Saner, 2021).

The most important obstacle in the development of animal husbandry is the lack of cheap and sufficient quantity and quality feed. A balance should be established between supporting plant production and supporting animal production. In addition animal husbandry enterprises should be provided with cheap, sufficient amount and quality feed input. Large-scale livestock enterprises should be encouraged (Azmak, 2012). Agricultural products such as alfalfa and vetch, which are used as animal feed in low-yield lands, can be grown, and animal husbandry activities can be moved from the indoor environment to the natural environment (Taş, 2011).

Since being ignorant to animals can cause irreparable economic losses, animal diseases and pests should be fought effectively and protective measures should be taken on time (Şahin et al., 2014). One of the basic rules of increasing efficiency in animal production enterprises is to work with high-yielding breeds. Working with highly productive culture breeds and improving the maintenance and feeding conditions are the basis of increasing the yield. For the development

of animal husbandry, it is necessary to ensure that modern inputs and technologies are used adequately to control whether they are used appropriately after agricultural supports are given (Şahin and Karadağ Gürsoy, 2016).

World countries are an important country that is a source of genes for many plant and animal products. Necessary precautions should be taken for the research, development and effective use of these gene resources. A fast and effective research and development system should be established in order to determine the gene resources to be obtained from abroad and to adapt them to the conditions of the countries. Artificial insemination in livestock should be encouraged (Azmak, 2012).

The digital age is the time period in which the value of information is more appreciated in the late twentieth and early twenty-first centuries. The number of smart phones, which are the products of mobile operating systems, is increasing rapidly with the increase in the world population. The widespread use of social media has increased the adaptation of human beings to these technologies. Technological advances are accelerating in the digital age. Everything that has not been digitized will lose its sustainability in the long run (Gökkür & Arda, 2022).

While most of the farmers in many parts of the world continue their activities with traditional methods, they remain unaware of the developments in technology. Sustainable agricultural production will be possible by sharing the information in the triangle of producers, researchers and experts. As a result of the developments in information technology, there is no point in the world where information cannot be reached. As a result of the developments in electronic technology, it has become possible to collect soil, plant and environmental information needed by agricultural production. Agricultural machinery used today is equipped with different sensors and variable rate application systems. In this context, the necessity of gathering the developments in the fields of agriculture and technology on a common platform has emerged. Cloud computing technology, on which the industrial Informatics has been working intensively lately, may be a solution to the needs of the agricultural sector (Ünal & Topakcı, 2013). All technologies used in digital agriculture (drones, monitoring plant diseases and pests, systems that measure data on climate parameters, etc.) must have high data storage capacity (Gökkür & Arda, 2022).

The work to be done in this regard; can be listed as follows (Ünal & Topakcı, 2013):

- Establishing service providers to collect and analyze agricultural information in a common pool and make it available to users
- Developing application software that will enable the transfer of data (GPS, sensors, etc.) collected from agricultural areas in appropriate formats to established service providers
- Developing necessary software for environments that provide information to the system, such as research centers, universities, input producers
- Analyzing and evaluating all collected information and developing expert system software to inform users

Gökkür & Arda (2022) state that while using digital agriculture technologies, the phenologies of all varieties of fruit species grown are different. Phenology follow-up should be based on varieties. When we consider the life cycle of fruit trees, fruit yield decreases as the trees old age. For this reason, evaluations should be made according to tree age in yield estimation systems. Some plant identification programs sometimes make inaccurate plant identifications because they have as much information as the data they store. The problem can be solved by the cooperation of these programs with search engines. Because some of the plant identification programs store location information, due to the risks of security vulnerabilities, it may pose the problem of unauthorized collecting of genetic resources. When using such programs, the location information of the plants should not be shared.

Agricultural cloud computing technology can create an environment where farmers can access all kinds of agricultural information, analysis and recommendations with their smartphones. As a result, cloud computing technology will help users to share information in a common pool in agricultural production processes. This will make it possible to access the information needed by knowledge-based agricultural practices at any time via inexpensive communication tools (Ünal & Topakcı, 2013). In the digital age, access to information should be on the same terms

(equal) in the whole society. The widespread use of digital agricultural technologies should not cause our farmers to move away from their lands in the future. New situations (new diseases and pests, etc.) that may arise with the unexpected effects of climate change can be determined and resolved by farmers' evaluations in the field (Gökkür & Arda, 2022).

Agricultural production areas should be close to cities. Thus, by reducing fuel consumption and transportation costs, input costs will decrease and nature will be protected with less CO_2 emission. With the increase in the use of the internet in the marketing of agricultural products, the price difference between regions may decrease. Since digital agriculture technologies are being used in all activities in agriculture, smart agriculture technologies should be added to the structure of the value chain (Gökkür & Arda, 2022).

In some countries, farmers' markets and farms are widely used, where farmers and people who live in the cities can interact and shop directly. In both of these methods, social media is actively used. Customers are informed about which product is available that week, which product is fresh, and price details are shared. Thus, continuity in production and integration of the rural population with the city is ensured. In Spain, there are markets where farmers sell, supported and managed by municipalities. Besides the markets, the people who live in the cities can visit the gardens and farms where production is made and meet their needs from these gardens. In addition, with alternative food networks created, relations between producers and consumers are regulated. Thus, production of any crops will reach consumers with fewer intermediaries and the stages in the value chain will be shortened. In order to improve the protection and preservation conditions of the agricultural products produced during the marketing phase, measures should be taken by the relevant municipalities and portable storage units should be established (Çörek Öztaş & Karaaslan, 2017).

Farmers should earn the most income from agriculture. Otherwise, the farmer's welfare and desire to be a part of agricultural production may be destroyed. This problem can be easily overcome with the participation of farmers in e-commerce and branding their crops.

Conclusion

In order to keep the agricultural sector dynamic in a sustainable way, a highly competitive agricultural sector should be built structurally. For this, first of all, it is necessary to improve the living conditions of the rural population and increase labor productivity. The population living in rural areas should have non-agricultural incomes in addition to their agricultural incomes. If the non-agricultural income of the farmers is the income to be obtained from the countryside, agricultural production will develop in a sustainable way.

While planning agricultural production, the value chain of agricultural products as a whole should be taken into account. Technologies and methods should be used to minimize the losses that may occur in harvest, storage, processing, packaging and transportation of the crop. Crops considered as lost should be evaluated in different ways and used in the food industry. In post-harvest activities, a marketing network suitable for the domestic and foreign market should be established according to the shelf life of agricultural products. Moreover excessive use of fertilizers and pesticides by farmers without soil analysis increases farmer input costs and reduces the productivity of agricultural lands. Farmers should have soil analysis done every year, detecting the missing organic substances and minerals in the soil and adding them. Besides planting the same crop every year in soils with low productivity may adversely affect the structure of the soil. Crop rotation, which is a method of planting one crop for one year and a different crop the next year, can be used on lands with low fertility. In order to protect the world's agricultural lands, it is not sufficient only to put them into practice with physical planning, but also the awareness of the protection of agricultural lands should be placed in the active memory of human beings.

There should be a place for agricultural production, in the regional development areas of the countries. In areas that are not suitable for ecological restoration and do not contain ecological residues, agriculture can be done considering the condition of natural resources. The spread of agricultural production to all regions of the countries will contribute to increasing social welfare, the importance of agriculture to settle in the minds of consumers, and even healthy nutrition

at different rates. In order to increase the employment rate in agriculture, it is possible for the young population to love and adopt agricultural production. The spread of national and regional similar agricultural regions in our world will secure the right of human beings to access food. Besides, the cultivation of high-yielding agricultural crops can be expanded on lands that have not been used for agricultural production before. By using traditional or strategic products with low agricultural returns as raw materials in the industrial sector, the protection of the planted areas can be ensured.

For the agricultural crops grown, all countries of the world should make a classification according to their agricultural production purposes. These agricultural production purposes are shown in the figure 2 below.

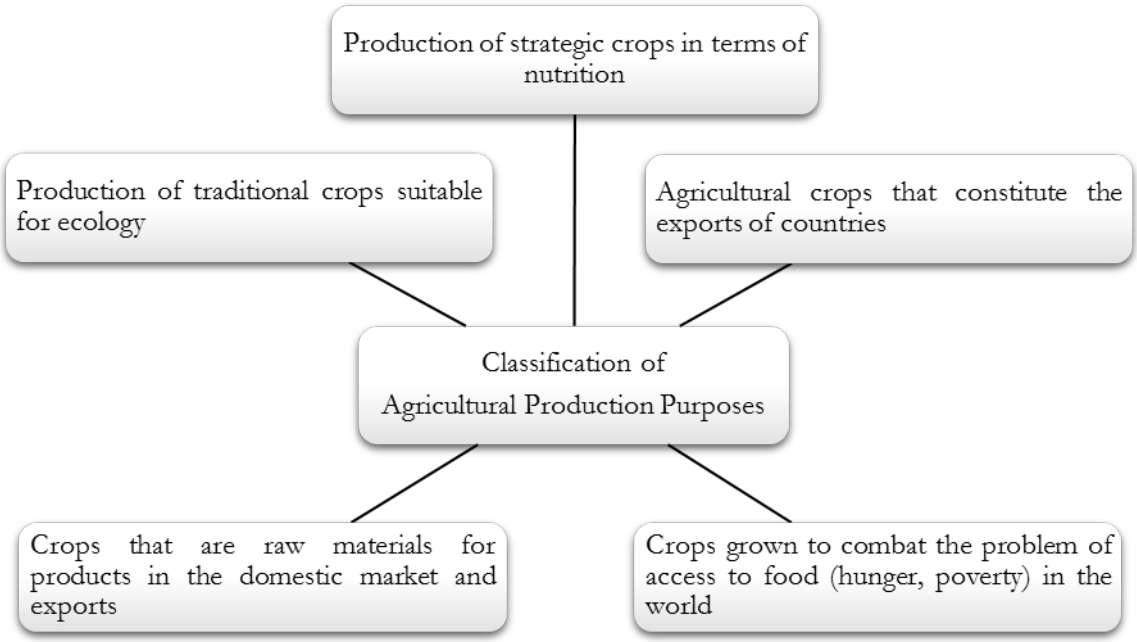

Figure 2. Classification of agricultural production purposes

The low income from agriculture and the decrease in the population that makes a living from agriculture are the biggest problems that reduce agricultural production. This problem can be solved by restructuring the manufacturing industry to develop with agricultural production. The role of the manufacturing industry is great in transforming the raw material obtained from agriculture into a different product to be consumed through post-harvest processes. In addition to the added value created by the manufacturing industry and the consumption of traditional agricultural products in different ways, products entering the food and beverage sector as new products also have positive contributions to protecting food safety. The fact that agricultural crops can be used as raw materials in the manufacturing industry positively affects the economies of countries. However, sustainable production should be guaranteed in the areas where these crops are grown. Planning of agricultural areas and planning of forest areas should be done together. Since the plants grown in these areas are used as raw materials in the manufacturing industry, their economic benefits should be evaluated together. If agriculture is not developed in countries where the manufacturing industry is developed, the manufacturing industries and economies of some countries may be adversely affected after future pandemics, wars, climate change and natural disasters. Countries with the development of agriculture and the manufacturing industry will be less adversely affected by unexpected events in the future. Manufacturing industrial zones can be established on unproductive lands close to agricultural production areas. Establishment of facilities with low carbon footprints required for the processing and marketing of agricultural products that provide raw materials to the manufacturing industry is important for the protection of the world's natural resources.

Today, yield and quality alone are not sufficient criteria in the cultivation of agricultural products. Varieties that will be less affected by climate change (resistant to dry conditions, low cooling need, grown in high ground water levels, less affected by late spring frosts), disease and pest resistant varieties are indispensable for agricultural production. Firstly,

the varieties used in agricultural production should be resistant to diseases and pests. Since the spraying costs of these varieties will be lower, the total input costs will also be less. In order to protect the food supply against the unexpected effects of climate change, mid-early or late varieties can be grown in addition to the early varieties grown in some regions. Artificial intelligence systems can be used together with early warning systems to take precautions against the negative effects of climate change. Secondly, with excessive fertilization, our soil and water resources are polluted. Our farmers should plan their fertilization activities according to the soil analysis that they will do every year. Governmental agricultural institutions of the countries can assist our farmers in soil analysis. What is more, the decrease in the number of agricultural workers in many countries of the world puts the farmers in difficulties especially during the pruning and harvest seasons. These problems can be solved by disseminating farmer training programs, determining the income of farmers according to their working hours and the difficulty of the work, and by working to ensure that the farmers stay in the countryside. In agricultural production, training programs should be organized that will make positive contributions by adapting traditional production methods to new modern production methods.

Contracted agricultural production is part of both the value chain of the agricultural products grown and the supply chain. It facilitates the meeting of agricultural products with the producer. In contracted agricultural production, companies should not prepare contracts alone. To protect our growers, contracts can be drawn up together with engineers, growers, firms and public institutions. World countries can create a standard contract format in favor of growers. By adding clauses to this standard contract, a suitable contract can be drawn up for all agricultural products. Computer software should be prepared to monitor the fulfillment of contracts and to make production forecasts in the coming years.

Contracted agricultural production provides the opportunity to transfer continuity to future generations in agriculture and the manufacturing industry, which provides raw materials from agriculture, by guaranteeing agricultural production with a contract. In order to increase agricultural production and farmer welfare under all circumstances, states should standardize the cost of inputs used in production. In order to ensure food security and protect the right of human beings to access food, the financial support provided by the states for the protection of the welfare of our farmers will certainly contribute more to the countries economies. The increase in the confidence of the countries in the economy also depends on the sustainability of food security. Contract agriculture will provide the opportunity to protect the future of food security by enabling young people to make a living from agriculture. Advances received by farmers in contracted agricultural production may accelerate the transition of some farmers to machine farming and digital farming. With the support of the states, a new structure can be established under the name of Contracted Digital Agriculture, which brings together the producer with new technologies through purchases or rentals.

Traceability studies are important in all activities of the value chain in agricultural production. Contracted agricultural production can be reorganized as part of traceability studies. Traceability of all cultural activities, pre-harvest activities and post-harvest activities in the regions where agricultural products are grown will accelerate the intervention of future problems at the right time. Another part of traceability studies is the recording of this information. Data protected by record keeping is important as it can be used to predict future production and yield. Controlling all stages of the value chain in agricultural production by engineers working in public institutions will make positive contributions to the decrease in farmer production costs, increase in yield and quality in agricultural products, increase farmer welfare and the development of the economies of world countries.

Self-sufficiency rate for crops indicates how much of the country's domestic demand for each agricultural crop produced is met. The fact that self-sufficiency rate for crops in agricultural products is related to demand, which is a variable component, necessitates the need to be careful in the arrangements to be made in agricultural production planning. Consumers plan their product demands in relation to their income. When the market price of a crop becomes too high to buy, consumers may alter their demand to other products. This situation may cause changes in the self-sufficiency rate for crops. When calculating self-sufficiency rate for crops in each agricultural product, the value determined by taking into account the annual amount that a healthy person should consume and the number of

population should be accepted as the minimum self-sufficiency rate for crops. In recent years, agricultural products have been faced with low yields due to reasons such as excessive precipitation, hail, frost or diseases seen for the first time in various parts of the world. This could jeopardize world food supply security. The determination of the self-sufficiency rate in agricultural products may differ according to the ecology of each country and whether it can be positively or negatively affected by climate change. The plans to be made regarding the cultivation of agricultural crops should be such that they do not cause a decrease in the amount of exports. Arrangements to be made in agricultural production planning should facilitate consumers' access to food. In addition, consumers should not be directed to choose alternative or different crops instead of the crops they want to consume.

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Salih Gökkür graduated in 2000 from Ege University, Faculty of Agriculture, Department of Farm Structures and Irrigation, where I started in 1996. I completed my compulsory internship at Izmir Konak Municipality, Directorate of Parks and Gardens in 1999. I completed my master's degree in 2003 at Ege University, Graduate School of Natural and Applied Sciences, Department of Farm Structures and Irrigation where I started 2002. Then I took various lessons from Muğla Sıtkı Koçman University, Department of Economics, Bachelor's Degree Program, Masters of Science Program and Doctoral Program. I was appointed to Aegean Agricultural Research Institute in 2011 and continues my duty as a researcher working on fruit growing techniques and breeding, economics and climate change. I write about agriculture and economy in Apelasyon E-Journal.

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https://apelasyon.com/yazarlar/salih-gokkur

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