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Turkey and Japan Agricultural and Mechanization Status Comparison

Türkiye ve Japonya Tarım ve Tarımsal Mekanizasyon Durumunun Karşılaştırılması

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ABSTRACT

Objective: This study is a pilot study in terms of new connections and technology transfers that can be created between Japan and Turkey, aimed to provide recommendations by comparing Japanese and Turkish agriculture.

Material and Methods: Agriculture and agricultural data were collected, calculated, and analyzed from statistical and written sources. Comparable data were taken and compared.

Results: Japan's total agricultural area is approximately 12% of Turkey. Mechanical power supply tractors, one of the main power sources used in agriculture, are found in almost the same number in both countries. However, the soil structure, the product produced and the size of the land in the country affect the choice of tractor. Therefore, while in Japan the average tractor power is between 18 to 30 kW, 44 to 52 kW in Turkey. In both countries, each agricultural business has at least 1 tractor. The number of tractors used in the cultivation of 1000 hectares gives us information to make a comparison about the small scale of the agricultural land used. 1000 hectares of land in Japan when processing 310 tractors, this situation is 55 tractors in Turkey. While the average age of farmers in Japan 67, the average is 55 in Turkey.

Conclusion: The population dealing with agriculture should be rejuvenated and the machines used should be made more technological. More effective production can be made with sustainable agriculture and renewable energy. In this way, both the reduction of input costs and the labor force, and the sustainability of agriculture with projects can be aimed at young people are ensured.

Keywords:

Agricultural mechanization, Japan,
Sustainable agriculture, Turkey.

Anahtar Sözcükler:

Japonya, Tarımsal mekanizasyon,
Sürdürülebilir tarım, Türkiye.

ÖZ

Amaç: Japonya ve Türkiye arasında oluşturulabilecek yeni bağlantılar ve teknoloji transferleri açısından önemli olan bu çalışma, Japon ve Türk tarımını karşılaştırarak öneriler sunmayı amaçlamıştır. Japonya'nın toplam tarımsal alanı Türkiye'nin yaklaşık %12'si kadardır.

Materyal ve Metot: Tarım ve tarımsal veriler, istatistiksel ve yazılı kaynaklardan toplanmış, hesaplanmış ve analiz edilmiştir. Karşılaştırmalar ortak veriler üzerinden yapılmıştır.

Bulgular: Tarımda kullanılan güç kaynaklarının başında gelen mekanik güç kaynağı traktör, her iki ülke içinde neredeyse aynı sayıda bulunmaktadır. Ancak ülke içerisindeki toprak yapısı, üretilen ürün ve arazi büyüklükleri traktör seçimini etkilemektedir. Bu nedenle Japonya'da ortalama traktör gücü 18 ila 30 kW arasında iken Türkiye'de 44 ila 52 kW arasındadır. Her iki ülkede de her tarımsal işletme en az 1 traktöre sahiptir. 1000 hektarlık alanın işlenmesinde kullanılan traktör sayısı bize kullanılan tarım arazilerinin küçük ölçekli olduğu hakkında karşılaştırma yapabilmek için bilgi vermektedir. Japonya'da 1000 hektar alanı 310 traktör işlerken Türkiye'de bu durum 55 traktördür. Japonya'da çiftçi ortalama yaşı 67 iken, Türkiye'de ise ortalama 55'tir.

Sonuç: Tarım ile uğraşan nüfusun gençleştirilmesi ve kullanılan makinelerin daha teknolojik hale getirilmesi gerekmektedir. Sürdürülebilir tarım ve yenilenebilir enerji ile daha efektif üretim yapılabilir. Böylelikle hem girdi maliyetlerinin ve iş gücünün azalması, hem de gençlere yönelik projelerle tarımın sürdürülebilirliği hedeflenebilir.

INTRODUCTION

Japan consists of 47 provinces on 4 islands. Every region of Japan is actively engaged in agriculture. According to 2015 data, the total agricultural area is 4.496.000 hectares. 2.050.000 hectares of this area is pasture area. The area used in agriculture is decreasing every year. According to the latest statistical data, an average decrease of 0,43% is observed. Agricultural income is usually earned from vegetables and rice. In addition, fruit is produced. 97.3% of total agricultural enterprises are family enterprises. The export rate among the total produced tractors increased every year. When the number of tractors, rice planting machines and combined harvesting machines are examined, a decrease is observed within 5 years.

Turkey's total agricultural area of 37,817 (thousand hectares) and 14,617 (thousand hectares) is located in grassland areas. There are approximately 3 million agricultural businesses in Turkey (TUJK, 2016). A lot of agricultural products are produced in Turkey. For example, corn, sugar beet, wheat, tomato, potato, watermelon, etc. In addition to agricultural production, animal production is carried out. Operational structure, produced products and processes change the structure of used tractors and equipment.

MATERIAL and METHOD

Turkey Statistical Institute web page (TUIK), brands web pages or distributors, The Turkish Association of Agricultural Machinery and Equipment Manufacturers (TARMAKBIR), Ministry of Agriculture, Forestry and Fisheries statistical web page, Japan Agricultural Machinery Manufacturers Association (JAMMA) Statistics web page, Food, and Agriculture Organization of the United Nations data web page and Statistics of Japan web page (e-stat) according to data obtained from the web pages and resources based on analysis of data that the other written and library information, calculable data had calculated with Excel and prepared results.

Turkey and Japan maps are given to from Figure 1 to Figure 4 for information about the positions in the world and countries' prefectures borders.

After obtaining data, calculations such as area per tractor, number of tractors per area and number of machines per 100 tractors will be made. Average tractor power will be obtained. By making calculations on tractor production and export, the idea of production will be revealed.



Figure 1. Geographical Position of Turkey in Europe and Asia

Şekil 1. Türkiye'nin Avrupa ve Asya'daki Coğrafi Pozisyonu



Figure 2. Map of Turkey's Provinces Borders
Şekil 2. Türkiye İl Sınırları Haritası

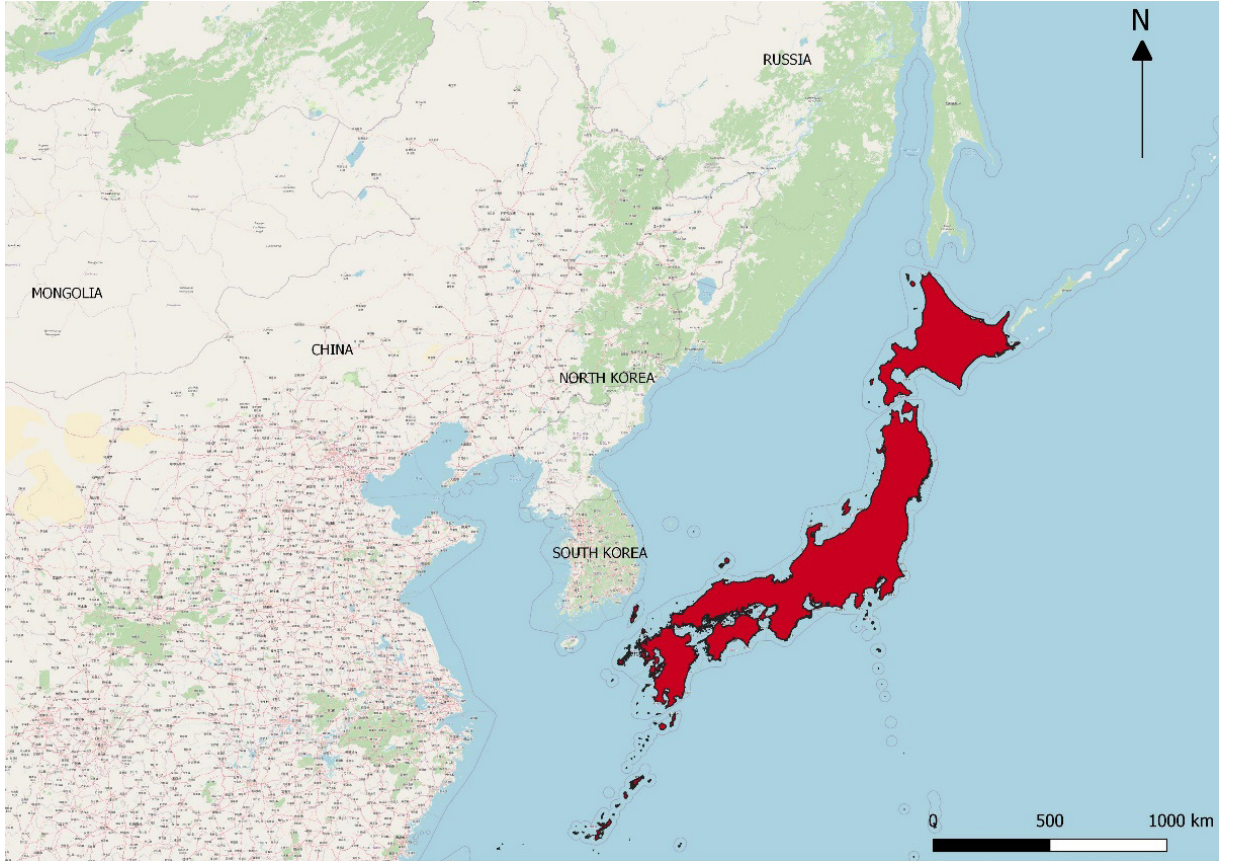


Figure 3. Geographical Position of Japan in Asia
Şekil 3. Japonya'nın Asya'daki Coğrafi Pozisyonu

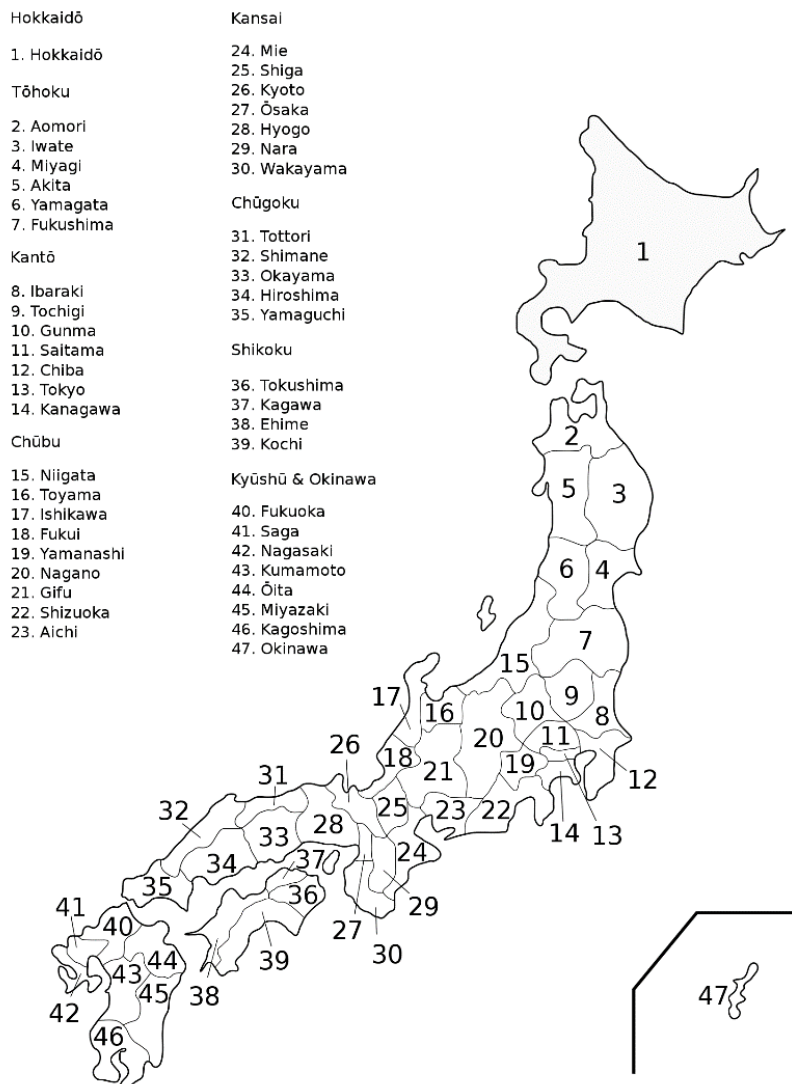


Figure 4. Map of Japan's Provinces Borders

Şekil 4. Japonya İl Sınırları Haritası

RESULTS and DISCUSSION

According to the information obtained as a result of written source scanning, the following conclusions can be drawn. When we look at the export values of agricultural equipment in 2018, it is seen that it is 1 billion dollars. The renewal rate of the existing tractor park has decreased in recent years (Yılmaz and Sümer, 2018). This is due to increased input prices and reduced willingness to replace the new tractor. Irrigation systems were also taken into consideration when examining the status of agricultural mechanization. It is seen that some prefectures are at the forefront in the field of irrigation in Turkey. Besides, other agricultural equipment has been standing out. There is an increase in stubble drill, fruit harvesting and animal production machines. As

indicated in Table 1, Japanese farmers' average age is higher than Turkish farmers'. It was 55 in Turkey and 67 in Japan (Shimizu T. 2017; TUIK 2019). Given the average age, tractors and other mechanization tools used in Japan are expected to be more technological. Turkey, despite having 8 times more farmland than Japan, the number of tractors used in agriculture in the two countries are close. However, there is a decrease in the presence of mechanization in Japan. Since Japan generally cultivated rice, tractors and equipment are small in size. The average tractor power is between 18 and 30 kW. Turkey average tractor power is between 44 - 52 kW. Japan farmland is more fragmented and smaller than Turkey farmland and Turkey use machinery more effectively. The process serves 3.23 ha per tractor in

Japan, it is in Turkey 19 ha per tractor. The number of tractors in an area of 1000 ha can give an idea about how effectively the tractors are used and whether the land structure is fragmented. This assessment 310 tractors in Japan, while there are 55 tractors in Turkey. So, while

Japanese farmers operated 310 tractors per 1000 ha, but Turkish farmers operated 55 tractors per 1000 ha (Özgüven et al. 2010; Akdemir 2013; Korucu et al 2015). Therefore, large scale power tractors and equipment in Turkey, harvesters, etc. mechanizations are used.

Table 1. General Agricultural Information About Japan and Turkey

Çizelge 1. Japonya ve Türkiye Hakkında Genel Tarımsal Bilgiler

	Japan	Turkey
Field Area (ha)	4,496,000	37,817,000
Number of Tractor	1,170,000	1,332,139
Average Tractor Power (kW)	18 - 30	44 - 52
Average ha / tractor	3.23	19
Number of Tractor / 1000 ha	310	55
Farmers Average Age	67	55

The number of tractors produced in these two countries is given in Figure 3. Together with the production amount, we see the share of exports in production as percent (%). Japan exports 72% of its tractors on average. Turkey is exported while only 24%. The reason for this is that there are enough tractors used in Japan and that the new market is abroad. The remaining part can be considered as the renewal of domestic tractors. Used tractors are exported to developing countries. In this way, it continues to be used in tractors that have not completed their useful life. Turkey has allocated the largest share of the domestic use of the tractor perform the production

of domestic and foreign brands of tractors. Because Turkey is examined when the tractor is seen that the presence of the old tractor.

One of the reasons that factory production of foreign-funded companies in Turkey is that the raw materials cheaper. Therefore, there are investments made in Turkey. For example, New Holland, The Turk Tractor by agreeing realizes production in Turkey. SDF Group and AGCO Corporation opened their own factories and started production. The other reason is the position of Turkey in the Europe-Asia-Africa. It increases the possibility of export of tractors produced in Turkey.

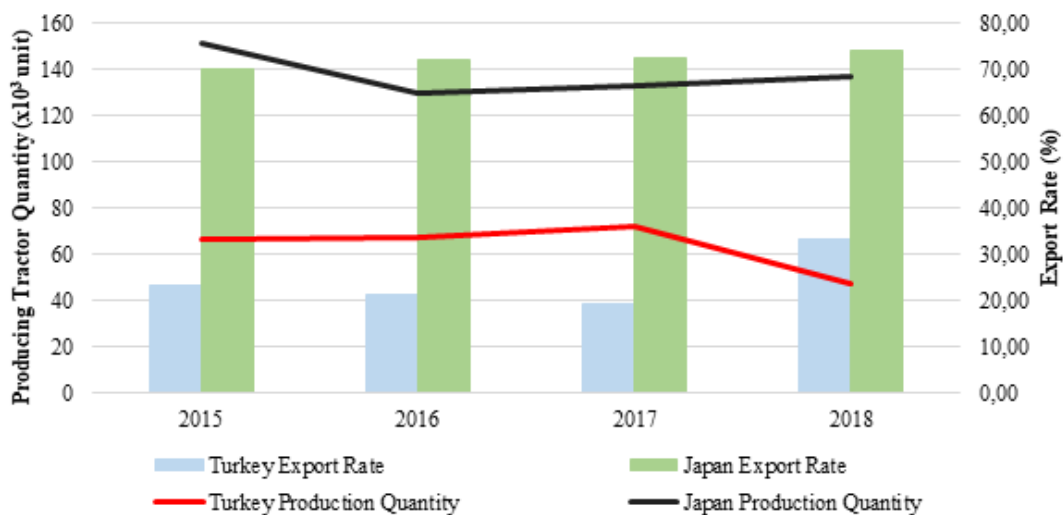


Figure 5. Export Rate and Total Production of Agricultural Tractors

Şekil 5. Tarım Traktörü İhracat Oranları ve Toplam Üretim Sayıları

Source: TARMAKBİR and JAMMA Statistical data 2019

Sales prices were analyzed according to the sources on dealers and websites. Although produced and sold in Japan, prices are high. It can be said that production costs are high in Japan. However, it can be interpreted that the purchasing power of Japanese farmers is higher. Production costs in Turkey are suitable position for production because of the low.

The number of harvesters in Turkey is quite low. The imported harvesters are used for grain harvest in Turkey. There are locally produced harvesting machines for other agricultural products. Purchasing costs are very high for Turkish farmers. Generally contracting services provide to use harvesters. Thus, a combine harvester works hard in the season. When analyzed in terms of annual working hours, it is reported in the TARMAKBİR Sector Report that it is 4 times more than normal (İleri 2019). According to the report, an average of Turkey harvesters 1200 h / year

is working. The situation in Japan is different. On average, one out of every 2 businesses has a combined harvester. As there is a difference in crops and area, the combine used in Japan is small and usually on paddy harvesting. However, rice harvest is done with big size combine harvesters using in Turkey.

As seen in Table 2, Japan seems to be high in terms of production area and production amount, but it is low in productivity. One of the reasons for this is the effect of different types of rice, weather and soil conditions, fertilizing and maintenance, irrigation and harvesting machines. Also, it issuable same situation at Table 3. However, each machine has a certain loss of harvest. If there is less loss in large machines, the loss in the total area is much less. Because there will be losses during each harvest. Since the harvested area harvests more area than the small machine, both losses are reduced and time is saved.

Table 2. Analyzed Paddy Data

Çizelge 2. Analiz Edilmiş Çeltik Verileri

Rice	Japan	Turkey
Planted Area (ha)	1,520,000	114,266
Production Quantity (tons)	8,157,333	890,000
Production Efficiency (tons/ha)	5.37	7.78

Table 3. Analyzed Wheat and Barley Data

Çizelge 3. Analiz Edilmiş Buğday ve Arpa Verileri

Wheat and Barley	Japan	Turkey
Planted Area (ha)	273,240	10,471,140
Production Quantity (tons)	1,050,120	28,350,000
Production Efficiency (tons/ha)	3.84	2.71

Source: MAFF 2019 and TUIK 2019 Data (Last 5 years' average values)

Turkey aimed to improve agricultural producing in 2018 until 2022. In the strategical plan includes, to constitute agriculture-industry-institute collaboration for research and development, to improve international certificate and geographical indication at products, to improve integrated pest control. Also, it includes to constitute soil databases, monitoring and management systems for quality products (Republic of Turkey Ministry of Agriculture and Forestry, 2018).

Japan supports to agriculture with SDGs (Sustainable Development Goals) for sustainability. That project includes smart agriculture and renewable energy works. Smart agriculture demonstration projects have been started 69 districts across the country over 2 years. Such as, aerial spraying of pesticides with drone, variable fertilizer rice planter, wireless remote mower, etc. Also, technological developments in agriculture written by

Torii in 2000. These are tilling robot, automatic follow-up vehicle, automatic transport vehicle.

Renewable energy projects have been started in both countries. First of all, renewable energy sources have been transformed to electric. Because electric is important source for all producing areas. Developing technology and changing demands related to this have been increased the use of solar and biomass in renewable energy. Renewable energy sources and electricity generation values are given in the Table 4. (Khan and Ramesh 2013; MAFF 2019).

Sources: FY2019 Summary of the Annual Report on Food, Agriculture and Rural Areas in Japan, MAFF, and Turkish Statistical Institute data web page 2020 Japan's data show improving solar energy using in renewable energy sources. The most of improving has been 3.5 times between 2012 to 2014.

Table 4. Renewable Energy Source and Electricity Generation (x100 million kWh)**Çizelge 4.** Yenilenebilir Enerji Kaynakları ve Elektrik Üretimi (x100 milyon kWh)

Years	Renewable Energy Sources			
	Hydro		Others (Solar, Biomass, Wind, Geothermal)	
	Japan	Turkey	Japan	Turkey
2010	328	518	253	40
2012	765	580	308	74
2014	835	406	490	123
2016	795	672	742	236
2018	810	600	963	387

Sources: FY2019 Summary of the Annual Report on Food, Agriculture and Rural Areas in Japan, MAFF, and Turkish Statistical Institute data web page 2020

Table 5. International Agricultural Exhibitions**Çizelge 5.** Uluslararası Tarımsal Fuarlar

Fair Name	Location
Agri World	Chiba/Tokyo, JAPAN
Agro Innovation Japan	Koto/Tokyo, JAPAN
AgroExpo	İzmir, TURKEY
Agrotec	Ankara, TURKEY
Bursa Agriculture	Bursa, TURKEY
Bursa Stockbreeding and Farm Equipment Fair	Bursa, TURKEY
Growtech Eurasia	Antalya, TURKEY
World Food Istanbul	İstanbul, TURKEY

International fairs are very important for producers, researchers and farmers. For manufacturers and researchers, fairs are important for improving the mechanization in their own country. It is important for researchers in symposiums along with fairs. Farmers can observe or to buy more technological or more useful mechanization at fairs (Savran et al. 2018).

CONCLUSION

If it is given combine with larger contracting services such as a Turkey harvesting process is done in less time and costs to farmers are reduced expenditure for the purchase of the combine harvester. Within both countries, they need to develop policies to direct young farmers to agriculture. Government supports are important for machine purchases. Therefore, government subsidies should be increased. International fairs should be organized in both countries. In order to see and learn the technologies and techniques used by both countries, agreements should be made between the two states and technical trips should be made for the farmers in certain periods.

In order to avoid the need for raw materials for tractors manufactured in Japan and the cost incurred in exports after tractor manufacture, tractors to be used in Japan and to be exported to nearby countries should be produced in Japan. Production of tractors in Turkey exports to European and African countries and shipping will be more appropriate. Japanese brands of tractor sales in Turkey who want to do is to keep prices low. To do this, you have to do is manufacture in Turkey. Turkey's position is thus sending the Japanese tractor to European countries will be easier and cheaper. Turkish tractor companies can Also, produce more technological tractors and enter the Japanese market. It is preferable to Japanese farmers if it is sold with high technology and cheaper than tractors manufactured in Japan. Thus, bilateral relations will be strengthened for both countries.

Technological collaborations have to do for more technological machine use in Turkey. In both countries, the problems of farmers should be determined by the agricultural engineers and agricultural directorates and the studies should be carried out in cooperation with the university between industry.

Domestic investments require for harvester producing at Turkey. Government should support to agricultural industry. So farmers or contracting services can buy more cheaply harvesters than imported harvesters.

The use of drones in agriculture is a significant development. A more effective and higher quality production can be achieved by applying variable level applications with a drone in fertilization and pesticide applications in agricultural production. The availability of empty rugged lands for biomass production can Also, increase the use of wireless remote movers.

Improvements can be made in irrigation mechanization in agricultural areas with the use of

renewable energy. Thus, sustainable production can have ensured with correct and effective use of soil and water resources. Generating electricity with biomass, a renewable energy source in pasture fields can make a contribution to the country's and farmers' economy.

Last terms have been observed that some basic needs are postponed due to global epidemics and natural disasters, but the need for food has increased even more. For this reason, the importance and support given to agriculture and farmers should be gained importance and increased day by day. In this way, farmers can produce more effective and quality products. As a result of quality production, the products will become exportable and sustainable.

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