Projection of Machine Usage in Agriculture of Ardahan Province

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Abstract

In this study, the usage projection of agricultural machinery used in agricultural operations in Ardahan province was examined. It is aimed to determine the projection of technology use in agriculture by using the data between 2011-2020. The change rates of 35 machines, including tillage, sowing, planting, fertilization, spraying, harvesting-threshing and other machines, between 2011-2020 were examined. Projection coefficients were calculated and by using these, coefficients were calculated and evaluated for the years 2021-2030. In the study, the data of the Turkish Statistical Institute and findings from the related studies on the subject were used. It has been concluded that the positive projection coefficients of 29 machines considered in the technology usage projection will increase until 2030, while the projection coefficient determined for 6 machines is negative and there will be a decrease in these machines.

Keywords: Ardahan, Projection, Agricultural machinery

Ardahan İli Tarımda Makine Kullanımı Projeksiyonu

Öz

Bu çalışmada Ardahan ilinde tarımsal işlemlerde kullanılan tarım makinelerinin kullanım projeksiyonu incelenmiştir. 2011-2020 yılları arasındaki veriler kullanılarak tarımda teknoloji kullanım projeksiyonunun belirlenmesi hedeflenmiştir. 2011-2020 yılları arasında toprak işleme, ekim, dikim, gübreleme, ilaçlama, hasat-harman ve diğer makineleri içeren 35 makinenin değişim oranları incelenmiştir. Projeksiyon katsayları hesaplanmış ve bunlar kullanılarak 2021-2030 yılları için katsaylar hesaplanmış ve değerlendirilmiştir. Çalışmada, Türkiye İstatistik Kurumu’nun verileri ve konu ile ilgili yapılan çalışmalarдан elde edilen bulgular kullanılmıştır. Teknoloji kullanım projeksiyonunda ele alınan 29 makinenin pozitif projeksiyon katsaylarının 2030 yılına kadar artacağı, 6 makine için belirlenen projeksiyon katsayısının ise negatif olduğu ve bu makinelerde azalma olacağını sonucu varılmıştır.

Anahtar Kelimeler: Ardahan, Projeksiyon, Tarım makineleri.
1. Introduction

Mechanization has great importance in increasing production, work efficiency and quality of work in agriculture, facilitating work, reducing costs, modernizing enterprises, opening new business areas, and improving the socio-economic population of agriculture. (Altay and Turhal, 2011). In addition to the necessity of using natural resources effectively and efficiently for the sustainability of agricultural production, it is obligatory to apply techniques that can help the people in production to develop socio-economically. In order to fulfil these conditions, it is necessary to eliminate the deficiencies of the implemented system and to develop new and effective technologies (Kaya et al., 2010).

Agricultural mechanization shows different levels of development and practice in all countries. This difference can be seen in the regions of a country as well as in agricultural enterprises within the same region. Depending on the technical and economic structure of the agricultural enterprise, the level of agricultural mechanization can be in different values (Koçtürk and Onurbaş Avcıoğlu, 2007). Conducting studies in the field of agricultural mechanization with up-to-date data in line with developments in agricultural production systems and technologies; It is of great importance for making the right decisions for the future by contributing to the agricultural development plans at regional, national and provincial level (Bayram and Altuntaş, 2016).

The use of machinery in agriculture, unlike other applications of agricultural technology, indirectly affects the increase in productivity and provides the application of new production methods in rural areas. In this respect, it increases the efficiency and economy of other technological applications and improves working conditions. Thus, by enabling the use of appropriate technologies, it helps to get more efficiency from production areas of a certain size (Saral et al., 2000; Demir and Kuş, 2016). In this study, it is aimed to determine the agricultural mechanization projection of the province of Ardahan for the next ten years, until 2030 and these values will guide the mechanization plans in the region.

2. Material and Method

Located in the northeast of Anatolia, Ardahan Province is surrounded by Georgia and Armenia in the northeast, Kars in the south and southeast, Erzurum in the southwest and Artvin in the west. Due to the high altitude of the region and the variability of climate, cold winters are long, harsh and snowy. In the province, which has an altitude of 1829 m above sea level, it is observed that the temperatures can reach the highest point at 33.6 °C in summer and decrease to -30.4 °C in winter (Anonymous, 2021a). The agricultural area of Ardahan province yields cereals and other herbal products on 427392 da, vegetables on 90 decareas, and fruits, beverage and spice crops on 502 decares. The total agricultural area of Ardahan province is 427984 da, excluding meadow and pasture areas (Anonymous, 2021b). The material of the study consisted of the agricultural machinery data of the Turkish Statistical Institute for the years 2011-2020 for the province of Ardahan in general (Anonymous, 2021c). The projection coefficient was calculated based on the production and usage amounts of the technology used in agriculture in the past ten years. In this context, the usage projection of 35 machines commonly used in Ardahan (tilage, sowing, planting, fertilization, spraying, harvesting-threshing and other machines) has been taken into consideration.

In line with the increase or decrease in the projection coefficient, ten-year projections of technology-use in agriculture in Ardahan province were determined. Depending on the number of machines in the previous year and the coefficient determined for that machine, the projections up to year 2030 of the agricultural machines widely used in Ardahan were determined by using the method of Demir and Kuş (2016), Baran et al. (2019), Solak et al. (2019). A positive projection coefficient indicates an increase in the number of existing machines, and a negative projection indicates a decrease (Demir, 2013; Demir and Kuş, 2016).

3. Results and Discussion

In the study, the number of soil tillage machines in the past ten years, the change rates compared to previous years, the projection coefficients calculated depending on the number of machines and the number of machines in the ten-year period are given in Table 1. According to the change rates calculated for the years 2011-2020, as seen in Table 1, the projection coefficients for the mouldboard plow, tooth harrow, disc harrow, cultivator, disc plow, mouldboard stubble plow, roller, arc opening plow, disc stubble plow and rotary tiller are -0.06, 0.67, -0.51, 38.40, 17.22, 4.27, -12.61, 3.30, 9.17 and 13.86 (%) respectively. According to the projection coefficient calculated for the years 2021 and 2030, it has been calculated that the largest increase will be observed in cultivator by 38.40% and corresponding to 10572 units, and the largest decrease will be observed in roller by -12.61 and corresponding to 18 units. The importance attached to tillage before sowing in grain production can explain the high number of mouldboard tractor plows.

The number of machines for sowing, planting and fertilizing machines in the past ten years, the rate of change compared to previous years, the projection coefficients calculated depending on the number of machines and the number of machines in the ten-year period are given in Table 2. According to the change rates calculated for the years 2011-2020, as seen in Table 2, the projection coefficients calculated for the chemical fertilizer spreader, tractor seed drill, combined seed drill, solid manure spreader and potato planting machine are 4.51, 2.83, 9.04, 37.16 and 25.93 (%) respectively. According to the projection coefficient calculated for the years 2021 and 2030, it has been calculated that the biggest increase will be in the solid manure spreader by 37.16% corresponding to 10572 units. It is possible to claim that the increase in the number of combined grain seeding machines over the years in Ardahan is beaue of the importance of grain production. Similarly, the number of potato planting machines increased from 1 unit in 2011 to 4 units in 2020. With the projection coefficient of 25.93% stated in Table 2, it can be assumed that the number of potato planting machines will increase to 40 in 2030. It can be thought that the low number of potato planting machines is due to the fact that potato cultivation is limited to an area of 292.48 da (Anonymous, 2021d) according to 2020 data and grain production has a greater importance in provincial agriculture.

The number of machines belonging to plant protection machinery in the past ten years, the rate of change compared to
previous years, the projection coefficients calculated depending on the number of machines and the number of machines in the ten-year period are given in Table 3. According to Table 3, indicating the change rates for the 2011-2020 period, the projection coefficients for back sprayer; stretcher, motorized sprayer duster combined atomizer; motorized sprayer and atomizer have been respectively calculated as 2.35, 6.79, -0.13 and 5.40 (%). According to the projection coefficient calculated for the 2021-2030 period, the greatest increase will be in stretcher, motorized sprayer duster combined atomizer by 6.79%, corresponding to 23 units, and the greatest reduction will be observed in motorised sprayer by -0.13%, corresponding to 9 units. As indicated in Table 3, it can be said that there is not much trend towards spraying machines in the province and therefore, plant protection activities with pesticide coverage are not carried out too much. According to Anonymous (2021a), this can be explained by the fact that almost all of the plant production and bee products in the province are ecological.

The number of harvesting-threshing machines in the past ten years, the change rates compared to previous years, the projection coefficients calculated depending on the number of machines and the number of machines in the ten-year period are given in Table 4. The projection coefficients calculated for the harvester and threshing machine, tractor pulled mower, hay rake, straw transfer-unloading machine, reaper, hay making machine, hay silage machine, corn silage machine and potato harvesting machine were calculated as 0.24, 5.99, 2.89, 15.94, 6.51, -8.89, 6.15, 5.56, 5.56 and 20.37 respectively (Table 4). According to the projection coefficient calculated for the years 2021 and 2030, it has been calculated that the biggest increase will be in the potato harvester by 38.40% corresponding to 26 pieces and the biggest decrease will be observed in the number of reapers by -8.89 corresponding to 20 units. The fact that grain production has a greater importance in provincial agriculture can possibly have an effect on this. The high number of harvesting and threshers machines can indicate that grain production has a greater importance in provincial agriculture.

The number of other agricultural machinery for the past decade, the rate of change compared to previous years, projection coefficients and the number of machinery in the ten-year period are given in Table 5. The projection coefficients calculated for cream machine, churn, milking machine (mobile), milking facility, incubator, trailer, ladle, feed preparation machine, water tank and pump are -0.84, 0.08, 22.62, 37.62, 42.40, 2.18, 8.43, 1.19, 17.88 and 1.30 (%) respectively (Table 5). According to the projection coefficient calculated for 2021 and 2030, it has been calculated that the biggest increase will be observed in incubator by 42.40% corresponding to 823 units, and the biggest decrease will be observed in cream machines by -0.84 corresponding to 861 units. This can be explained by the fact that the economy of the province is based on agriculture in general and livestock sector in particular (Anonymous, 2021a).

### Table 1. Soil tillage machinery projection

| Past Years | Mouldboard Plow | Tooth Harrow | Disc Harrow | Cultivator | Disc Plow | Mouldboard Stubble Plow | Rolle r | Arc Opening Plow | Disc Stubble Plow | Rotary Tiller |
|------------|----------------|--------------|-------------|------------|------------|--------------------------|---------|----------------|-----------------|--------------|
| 2011       | 5670           | 3092         | 1141        | 137        | 47         | 114                      | 524     | 52             | 15              | 5            |
| 2012       | 5790           | 3152         | 1141        | 145        | 47         | 109                      | 304     | 52             | 16              | 6            |
| 2013       | 5810           | 3177         | 1146        | 149        | 48         | 109                      | 304     | 52             | 16              | 6            |
| 2014       | 5600           | 3181         | 1150        | 149        | 49         | 109                      | 304     | 53             | 16              | 6            |
| 2015       | 5719           | 3207         | 1158        | 150        | 59         | 118                      | 311     | 52             | 17              | 8            |
| 2016       | 5750           | 3234         | 1160        | 153        | 109        | 116                      | 319     | 53             | 17              | 8            |
| 2017       | 5470           | 3384         | 1075        | 732        | 144        | 117                      | 326     | 60             | 18              | 10           |
| 2018       | 5484           | 3384         | 1076        | 732        | 144        | 118                      | 326     | 60             | 19              | 10           |
| 2019       | 5569           | 3221         | 1076        | 411        | 158        | 122                      | 327     | 66             | 21              | 11           |
| 2020       | 5625           | 3275         | 1087        | 410        | 164        | 160                      | 69      | 69             | 31              | 15           |
| Exchange Rates | Mouldboard Plow | Tooth Harrow | Disc Harrow | Cultivator | Disc Plow | Mouldboard Stubble Plow | Rolle r | Arc Opening Plow | Disc Stubble Plow | Rotary Tiller |
| 2011-2012   | 2.12           | 1.94         | 0.00        | 5.84       | 0.00       | -4.39                    | -41.98  | 0.00           | 6.67            | 20.00        |
| 2012-2013   | 0.35           | 0.79         | 0.44        | 2.76       | 2.13       | 0.00                     | 0.00    | 0.00           | 0.00            | 0.00         |
| 2013-2014   | -3.61          | 0.13         | 0.35        | 0.00       | 2.08       | 0.00                     | 0.00    | 1.92           | 0.00            | 0.00         |
| 2014-2015   | 2.13           | 0.82         | 0.70        | 0.67       | 20.41      | 8.26                     | 2.30    | -1.89          | 6.25            | 33.33        |
| 2015-2016   | 0.54           | 0.84         | 0.17        | 2.00       | 84.75      | -1.69                    | 2.57    | 1.92           | 0.00            | 0.00         |
| 2016-2017   | -4.87          | 4.64         | -7.33       | 378.43     | 32.11      | 0.86                     | 2.19    | 13.21          | 5.88            | 25.00        |
| 2017-2018   | 0.26           | 0.00         | 0.09        | 0.00       | 0.00       | 0.05                     | 0.00    | 0.00           | 5.56            | 0.00         |
| 2018-2019   | 1.55           | -4.82        | -43.85      | 9.72       | 3.39       | 0.31                     | 10.00   | 10.53          | 10.00           | 5.56         |
| 2019-2020   | 1.01           | 1.68         | 1.02        | -0.24      | 3.80       | 31.15                    | -78.90  | 4.55           | 47.62           | 36.36        |
| %           | -0.06          | 0.67         | -0.51       | 38.40      | 17.22      | -12.61                   | 3.30    | 9.17           | 13.86           |
Projection | Mouldboard Plow | Tooth Harrow | Disc Harrow | Cultivator | Disc Plow | Mouldboard Stubble Plow | Roller | Arc Opening Plow | Disc Stubble Plow | Rotary Tiller
---|---|---|---|---|---|---|---|---|---|---
2021 | 5622 | 3297 | 1081 | 567 | 192 | 167 | 60 | 71 | 34 | 17
2022 | 5618 | 3319 | 1076 | 785 | 225 | 174 | 53 | 74 | 37 | 19
2023 | 5615 | 3341 | 1070 | 1087 | 264 | 181 | 46 | 76 | 40 | 22
2024 | 5612 | 3364 | 1065 | 1504 | 310 | 189 | 40 | 79 | 44 | 25
2025 | 5608 | 3386 | 1060 | 2082 | 363 | 197 | 35 | 81 | 48 | 29
2026 | 5605 | 3409 | 1054 | 2881 | 425 | 206 | 31 | 84 | 52 | 33
2027 | 5601 | 3432 | 1049 | 3988 | 499 | 214 | 27 | 87 | 57 | 37
2028 | 5598 | 3455 | 1043 | 5519 | 585 | 224 | 23 | 89 | 63 | 42
2029 | 5595 | 3478 | 1038 | 7639 | 685 | 233 | 21 | 92 | 68 | 48
2030 | 5591 | 3501 | 1033 | 10572 | 803 | 243 | 18 | 95 | 75 | 55

Table 2. Sowing, planting and fertilizing machinery projection

| Past Years | Chemical Fertilizer Spreader | Tractor Seed Drill | Combined Seed Drill | Solid Manure Spreader | Potato Planting Machine |
|---|---|---|---|---|---|
| 2011 | 327 | 43 | 25 | 2 | 1 |
| 2012 | 355 | 45 | 35 | 3 | 1 |
| 2013 | 393 | 48 | 40 | 3 | 1 |
| 2014 | 408 | 49 | 42 | 3 | 1 |
| 2015 | 407 | 48 | 43 | 10 | 3 |
| 2016 | 423 | 48 | 45 | 11 | 3 |
| 2017 | 450 | 49 | 45 | 14 | 4 |
| 2018 | 462 | 49 | 45 | 14 | 4 |
| 2019 | 482 | 50 | 48 | 15 | 4 |
| 2020 | 484 | 55 | 52 | 16 | 4 |

Exchange Rates

| Past Years | Chemical Fertilizer Spreader | Tractor Seed Drill | Combined Seed Drill | Solid Manure Spreader | Potato Planting Machine |
|---|---|---|---|---|---|
| 2011-2012 | 8.56 | 4.65 | 40.00 | 50.00 | 0.00 |
| 2012-2013 | 10.70 | 6.67 | 14.29 | 0.00 | 0.00 |
| 2013-2014 | 3.82 | 2.08 | 5.00 | 0.00 | 0.00 |
| 2014-2015 | -0.25 | -2.04 | 2.38 | 233.33 | 0.00 |
| 2015-2016 | 3.93 | 0.00 | 4.65 | 27.27 | 33.33 |
| 2016-2017 | 6.38 | 2.08 | 0.00 | 10.00 | 0.00 |
| 2017-2018 | 2.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2018-2019 | 4.33 | 2.04 | 6.67 | 7.14 | 0.00 |
| 2019-2020 | 0.41 | 10.00 | 8.33 | 6.67 | 0.00 |

% 4.51 2.83 9.04 37.16 25.93

Projection

| Past Years | Chemical Fertilizer Spreader | Tractor Seed Drill | Combined Seed Drill | Solid Manure Spreader | Potato Planting Machine |
|---|---|---|---|---|---|
| 2021 | 506 | 57 | 57 | 22 | 5 |
| 2022 | 529 | 58 | 62 | 30 | 6 |
| 2023 | 552 | 60 | 67 | 41 | 8 |
| 2024 | 577 | 61 | 74 | 57 | 10 |
| 2025 | 603 | 63 | 80 | 78 | 13 |
| 2026 | 631 | 65 | 87 | 107 | 16 |
| 2027 | 659 | 67 | 95 | 146 | 20 |
| 2028 | 689 | 69 | 104 | 200 | 25 |
| 2029 | 720 | 71 | 113 | 275 | 32 |
| 2030 | 752 | 73 | 124 | 377 | 40 |
Table 3. Plant protection machinery projection

| Past Years | Back Sprayer | Stretcher, Motorized Sprayer Duster Combined Atomizer | Motorized Sprayer | Atomizer |
|------------|--------------|------------------------------------------------------|-------------------|----------|
| 2011       | 51           | 8                                                    | 11                | 6        |
| 2012       | 47           | 8                                                    | 11                | 6        |
| 2013       | 52           | 13                                                   | 13                | 5        |
| 2014       | 50           | 12                                                   | 12                | 5        |
| 2015       | 55           | 12                                                   | 10                | 6        |
| 2016       | 57           | 12                                                   | 10                | 6        |
| 2017       | 58           | 9                                                    | 8                 | 6        |
| 2018       | 58           | 9                                                    | 8                 | 6        |
| 2019       | 61           | 11                                                   | 10                | 7        |
| 2020       | 62           | 12                                                   | 10                | 9        |

Table 4. Harvest-threshing machinery projection

| Past Years | Harvester and Threshing Machine (Thrasher) | Tractor Pulled Mower | Hay Rake | Baler Machine | Hay Transfer- Unloading Machine | Reaper | Straw Making Machine | Hay Silage Machine | Corn Silage Machine | Potato Harvesting Machine |
|------------|--------------------------------------------|----------------------|----------|---------------|--------------------------------|--------|----------------------|---------------------|----------------------|--------------------------|
| 2011       | 4194                                       | 2075                 | 2469     | 150           | 128                           | 250    | 26                  | 2                   | 2                    | 1                        |
| 2012       | 4185                                       | 2220                 | 2559     | 232           | 173                           | 250    | 27                  | 2                   | 2                    | 2                        |
| 2013       | 4199                                       | 2351                 | 2623     | 270           | 174                           | 250    | 29                  | 2                   | 2                    | 2                        |
| 2014       | 4303                                       | 2493                 | 2638     | 318           | 176                           | 250    | 30                  | 2                   | 2                    | 2                        |
| 2015       | 4343                                       | 2548                 | 2810     | 343           | 195                           | 50     | 31                  | 2                   | 2                    | 3                        |
| 2016       | 4381                                       | 2568                 | 2864     | 349           | 194                           | 50     | 37                  | 2                   | 2                    | 3                        |
| 2017       | 4406                                       | 2969                 | 2976     | 386           | 200                           | 50     | 40                  | 2                   | 2                    | 4                        |
| 2018       | 4411                                       | 2969                 | 3146     | 392           | 200                           | 50     | 40                  | 2                   | 2                    | 4                        |
| 2019       | 4094                                       | 3102                 | 3192     | 487           | 210                           | 50     | 43                  | 2                   | 3                    | 4                        |
| 2020       | 4268                                       | 3471                 | 3184     | 529           | 217                           | 50     | 44                  | 3                   | 3                    | 4                        |
### Table 5. Projection of other machinery

| Previous Years | Cream Machine | Churn | Milking Machine (Mobile) | Milking Facility | Incubator | Trailer | Ladder | Feed Preparation Machine | Water Tank | Pump |
|----------------|---------------|-------|--------------------------|------------------|-----------|---------|--------|--------------------------|------------|------|
| 2011           | 10069         | 6729  | 281                      | 30               | 3         | 4683    | 176    | 111                      | 23         | 150  |
| 2012           | 10129         | 6889  | 458                      | 30               | 3         | 4733    | 179    | 111                      | 27         | 150  |
| 2013           | 10109         | 6795  | 588                      | 40               | 3         | 4808    | 179    | 113                      | 29         | 152  |
| 2014           | 10077         | 6345  | 713                      | 35               | 3         | 4841    | 182    | 111                      | 30         | 150  |
| 2015           | 10134         | 6454  | 732                      | 53               | 3         | 5047    | 211    | 106                      | 32         | 148  |
| 2016           | 10150         | 6492  | 739                      | 48               | 12        | 5082    | 209    | 107                      | 32         | 150  |
| 2017           | 10137         | 6498  | 1316                     | 53               | 22        | 5346    | 223    | 113                      | 81         | 150  |
| 2018           | 10222         | 6458  | 1327                     | 53               | 22        | 5351    | 223    | 113                      | 81         | 150  |
| 2019           | 10267         | 6483  | 1349                     | 56               | 26        | 5501    | 333    | 118                      | 59         | 162  |
| 2020           | 9291          | 6752  | 1440                     | 205              | 24        | 5677    | 338    | 123                      | 59         | 168  |
4. Conclusions and Recommendations

Since mechanization is a high-cost production input, it needs to be chosen and applied correctly, otherwise it can negatively affect the profitability in enterprises. Since the most economical use of this input can only be possible by planning models that are suitable for local conditions, increasing the efficiency of mechanization in agriculture can be achieved by making agricultural mechanization planning correctly (Demir, 2013).

Based on the calculated projection coefficient, it is anticipated that the greatest increase in soil tillage machines for the 2021 to 2030 period will be observed in cultivators by 38.40%, corresponding to 10572 units, and the greatest reduction will be in rollers by -12.61, corresponding to 18 units; the greatest increase in sowing, planting and fertilization machines will be observed in solid manure spreaders by 37.16% corresponding to 377 units; the greatest increase in plant protection machines will be observed in stretchers, motorized sprayer duster combined atomizer by 6.79% corresponding to 23 units, and the greatest decrease will be observed in motorized sprayers by -0.13 corresponding to 9 units; the greatest increase in harvesters will be observed in potato harvesting machines by 20.37% corresponding to 26 units, and the greatest reduction will be observed in reaper machines by -8.89 corresponding to 20 units; the greatest increase in other machinery will be observed in incubator machines by 42.40% corresponding to 823 units, and the greatest decrease will be observed in cream machines by -0.84 corresponding to 8611.

As a result of the positive projection coefficients determined for the 29 machines examined in the research, it was concluded that the technology usage projection in the agriculture of Ardahan province will increase until 2030, and there will be a decrease in these machines in line with the negative projection coefficient determined for 6 machines. Since grain production, animal husbandry and dairy products have an important place in Ardahan province, it has been concluded that machines in this class tend to increase and that supporting the producers within the scope of these machines can bring a positive trend to the provincial agriculture.

References

Altay, F., Turhal, K., 2011. The Current Situations of Agricultural Mechanization in Bilecik and Solution Proposals. 6th International Advanced Technologies Symposium (IATS’11), 16-18 May, Elazığ, Turkey. (In Turkish)
Anonymous, 2021a. Turkey Republic Ardahan Governorship, Provincial Directorate of Environment and Urbanization. Ardahan Province Environmental Status Report for 2017. https://webdosya.csbgov.tr/db/ced/icerikler/ardahan_2017_cdr_son-20180605095733.pdf (Date of Access: 12/06/2021). (In Turkish)

Anonymous, 2021b. Turkish Statistical Institute, Crop Production Statistics 2021 https://tuikweb.tuik.gov.tr/PreTable.do?alt_id=1001 (Date of Access: 22/03/2021). (In Turkish)

Anonymous, 2021c. Turkish Statistical Institute, Agricultural Equipment and Machinery Statistics. https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr (Date of Access: 10/06/2021). (In Turkish)

Anonymous, 2021d. Ardahan Province Cultivated Agricultural Fields Product Report for 2020. Turkish Statistical Institute. (In Turkish)

Baran, M. F., Gökdoğan, O, Eren, Ö, Bayhan, Y., 2019, Projection of Technology Equipment Usage in Agricultural in Turkey, Türk Tarım ve Doğa Bilimleri Dergisi, 6(1): 1-9.

Bayram, M., Altuntaş, E., 2016. Investigation of Agricultural Mechanization Characteristics of Tokat Province for 2003 and 2013 Years. Tarım Makinaları Bilimi Dergisi, 12(3): 213-220. (In Turkish)

Demir, B., 2013. Projecton of Technology Usage in Agriculture of Mersin Province. Alıntıleri Zirai Bilimler Dergisi, 24(B), 29-34. (In Turkish)

Demir, B., Kuş, E., 2016. Projection of Technology Using in Agriculture of Central Anatolia Region. Nevşehir Bilim ve Teknoloji Dergisi TARGİD Özel Sayı, 89-95. (In Turkish)

Kaya, Y., Arsoy, R.Z., Taner, A., Aksoyak, Ş., Partigöç, F., Gultekin, I, 2010. Comparison of Conventional Plating and Direct Seeding for Wheat Cheak Pea Rotations in Central Anatolian in Rainfed Conditions. Tarım Makinaları Bilimi Dergisi, 6(4): 267-272. (In Turkish)

Koçtürk, D., Onurbaş Avcıoğlu, A., 2007. Determining Agricultural Mechanization Level in Terms of the Regions and the Cities in Turkey. Tarım Makinaları Bilimi Dergisi, 3(1): 17-24. (In Turkish)

Saral, A., Vatandaş, M., Güner, M., Ceylan, M., Yenice, T., 2000. Mechanization Situation of Turkish Agriculture” Union of Chamber of Engineers and Architects of Turkey Chamber of Agriculture 5th Technical Congress, 17-21 January, 901-923, Ankara. (In Turkish)

Solak, M., Saltuk, B., Baran, M.F., 2019. Projection of Agricultural Tools and Machinery Usage in Agriculture in Siirt. Ispec Uluslararası Tarım ve Kısral Kalkınma Kongresi, 10-12 Haziran, Siirt, 71-79. (In Turkish)