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INPUT USAGE AND PROBLEMS IN CHICKPEA PRODUCTION IN KÜTAHYA PROVINCE, TURKEY

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Abstract

Chickpea (Cicer arietinum) is an important cultural plant of the Fabaceae family, rich in nutrients and consumed almost everywhere in the world. Turkey has not been self-sufficient in recent years in the production of chickpeas. The chickpea`s producers prices were unstable. As a research field, Kütahya was chosen as one of the most important crops in terms of chickpea cultivation area and production in Turkey. There are more technical aspects of chickpea production in Turkey. The aims of this study were to examine socio-economic structures of chickpea producing farms in Kütahya province, and to analyse input usage and to determine problems related to production. The sample size was determined by stratified sampling method and was calculated as 85 chickpea farmers. The face-to-face survey method was used for obtained data from farmers. The study determined the usage of seed, fertilizers and pesticides and calculated the labour and machine power per hectare. The most important problems in the investigated area were the increase in input prices and anthracnose disease.

Key words: *chickpea, farmer, input, Kütahya, Turkey*

INTRODUCTION

Chickpea contains 16.4% - 31.12% protein. It is an important product in terms of protein in the diet to meet the needs of the growing population in the world and Turkey. [18][24] Chickpea also used as a yeast for making traditional bread in Turkey. Gül et al. [11] stated out that the bread characteristics and sensorial properties of chickpea bread were more pronounced than white wheat bread. At the same time chickpea generally takes place in gluten-free bread formulations [10].

Chickpea acreage was 878,000 hectares in 1991, reduced by 60% in 2016, decreased to 351,687 hectares in Turkey. Chickpea production was 855,000 tons in 1991 also fell by about 47% and fell to 455,000 tons in 2016. Over the years, the production and sowing area of chickpea tended to decrease continuously (Fig. 1).

The decline in production was less than in the sowing area, with increases in the yield (Fig. 1 and 2).

Uşak province is biggest share in Turkey chickpea cultivation area (8.26% ratio), however, the highest share in the production is Antalya (with a ratio of 7.59%). Important areas in chickpea production were Antalya, Uşak, Kırşehir, Konya, Mersin, Ankara, Karaman and Kütahya provinces. Compared to 2000, the cultivation area of chickpeas increased in Karaman, Kırşehir and Ankara and decreased in other provinces. According to 2000, chickpea production rose in Kırşehir, Ankara, Antalya, Karaman and Mersin.

In the province of Kütahya, chickpea sowing areas decreased by 33% compared to 1991, and production decreased by 14% (Fig. 1).

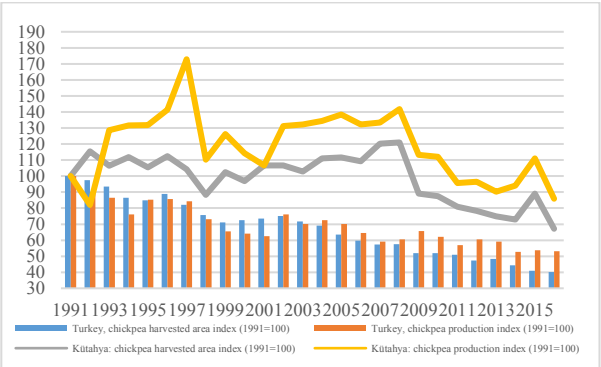

Fig. 1. Development of chickpea production and cultivation area in Turkey and Kütahya
Source: TUİK [22].

Kütahya province is the 46th place for the chickpea yield, and it is the 9th place for production and sowing area.

Turkey and Kütahya chickpea yields tend to increase in the years 1991 to 2016. But this increase has fluctuated (Fig. 2). The reasons for these are the production of chickpeas in arid areas and the direct influence in the weather conditions.

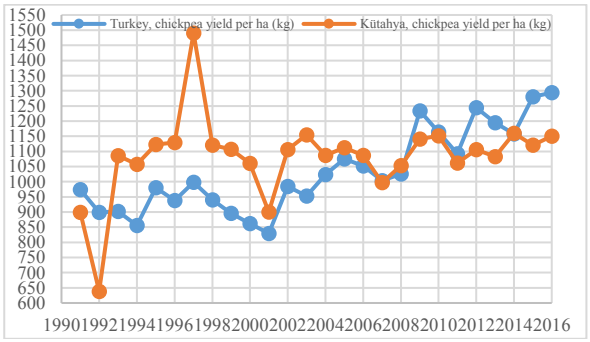

Fig. 2. Development of chickpea yield in Turkey and Kütahya
Source: TUİK [22].

Kütahya's share in the production of chickpea acreage is about the 2-fold increase in the years 1991 to 2016 (Fig. 3). Therefore, this province was chosen as the research area.

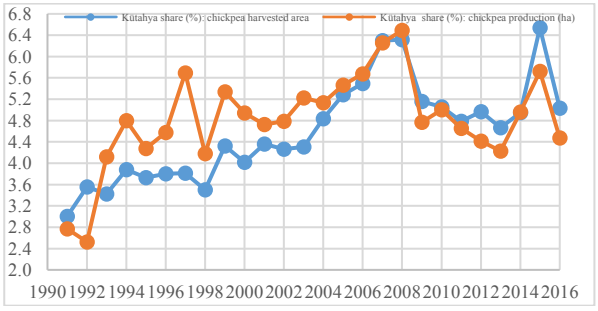

Fig. 3. Development of chickpea production and cultivation area in Turkey and Kütahya
Source: TUİK [22].

The aims of working at this point were: (i) to examine the socio-economic structure of chickpea farms in Kütahya, (ii) to analyse the use of inputs, (iii) to identify problems related to production and to develop them in solution proposals.

MATERIALS AND METHODS

The data were obtained by the face-to-face survey method from the farmers who made chickpea cultivation in Kütahya province. Also on the subject of the research findings conducted at national and international level was used. The data were from the 2016 production period.

The main population of the study consisted of farmers in the Merkez, Çavdarhisar, Dumlupınar and Gediz districts. These districts constitute 80.90% of chickpea production and 76.10% of sowing area in Kütahya province.

Simple layered sampling method was used [25] and Neyman Method was used in the stratification of the sample number [6]. Accordingly, the sample population to be represented by the main population was calculated as 85 farmers with a 95% confidence limit and 10% error margin. Farmers were divided into three groups (I., II. and III.) according to their frequency distribution, taking into account the size of cultivated chickpeas. First group's farmers (I) were defined as ranged between 0.10-0.400 ha of chickpea harvested area (15 farmers), the second group (II) was 0.401-1.50 ha (32) and third group (III) was 1.501 ha (38 farmers) and above. Descriptive statistics and tabulation were used to analyse of input usage and characteristics of the farms.

RESULTS AND DISCUSSIONS

The farmers' ages, education level, household size, experience level of agriculture and chickpea farming, and some indicators were given in Table 1 in the study area. The age of farmers was 50.13 years in the average. The first group of farmers was younger than the other groups with 45.87 years. The second group was the oldest with 51.69 years. Farmer's age was 50.50 years in the third group.

Farmers' education level was 6.94 years. The third group farmers' education level was higher with 7.37 years. The first group farmers' level was 6.80 years, and the second group was 6.50 years. Farmers' education levels were above the primary school level in the research region and these findings were close to the average education level of Turkey.

Chickpea farmers' household size was about 4 person in the research area. This value was about 5 person in the third group (Table 1). This value was 3.15 person in Kütahya province as a whole in the year 2013 [21]. Therefore, the rural area household size was more than the urban average.

Interviewed farmers had 27.84 years of agricultural experience. The second group had the most experimental in plant production with 29.59 years (Table 1).

Farmers' experience in chickpea production was more than 21 years. Experience level was higher in the third groups with more than 23 years. While the first group of farmers had 14 years, the second group had more than 22 years (Table 1).

The farmers interviewed had 0.89 credit cards in the average. The third group farmers had a maximum credit cards with 1.11 number. The debt status was again higher in the third group of farmers with 1,914.47 TRY (Table 1).

It was investigated the farmers' tendency to continue of producing chickpea. Responses from farmers were taken from Likert of 5. The farmers interviewed had a tendency to continue production. This tendency was greater in the third group (Table 1).

Farmers described their knowledge of chickpea production as moderate. Knowledge level was higher in the third group. This level was low in the first group. Farmers also expressed their level of satisfaction with chickpea production at moderate levels. This level of satisfaction was higher in the third group. But the satisfaction level of the first group was low (Table 1).

Consisting of agricultural land in Turkey has a multi-part problem. As a matter of fact, this result was also reflected in the findings of this research. The number of pieces of chickpeas land was 4.92 pieces in the average. Farmers of the third group had 8.16 pieces of chickpea land. The first group had the lowest number of land pieces with 1.40 pieces (Table 1).

Chickpea land size was 3.65 hectares in the average. First group farmers had 0.22 hectares, the second group farmers had 1.02 hectares, and the third group farmers had 7.22 hectares of chickpea land, respectively (Table 1).

The 95% of the farmers produced chickpea in their owned land. Generally, farmers interviewed was small-scale farmers and did farming in the owned land. The chickpea land's share was 31.82% in the total agricultural land. This value varied between 5.81% and 39.55% in the farm groups (Table 1).

Farmers' ownership of non-agricultural employment was 31.76% on average. The first group with 40% of farmers surveyed had the highest participation in non-agricultural work (Table 1). Agricultural income was important in the total income of the interviewed farmers.

About 7% of the interviewed farmers were earned agricultural income outside of their operation (Table 1).

Table 1. Some socio-economic indicators in the chickpea farms

Indicators	I	II	III	Average
Age of farmer (years)	45.87	51.69	50.50	50.13
Education level of farmer (years)	6.80	6.50	7.37	6.94
Household size (person)	3.93	3.25	4.53	3.94
Experience in agriculture (years)	22.13	29.59	28.61	27.84
Experience in chickpea production (years)	13.87	22.63	23.08	21.28
Number of credit cards (number)	0.60	0.78	1.11	0.89
Amount of debt (TRY)	1,016.67	990.63	1,914.47	1,408.24
Tendency to continue growing chickpeas *	2.87	3.22	3.87	3.45
Knowledge level in chickpea cultivation **	3.13	3.16	3.53	3.32
Satisfaction level in chickpea cultivation **	2.60	2.72	3.21	2.92
Parcels number of chickpea area (pieces)	1.40	2.72	8.16	4.92
Chickpea area (ha)	0.22	1.02	7.22	3.65
Owned land of chickpea area (%)	100.00	100.00	94.35	95.00
Share of chickpea area in total area (%)	5.81	14.50	39.55	31.82
Farmer engaged in non-agricultural work (%)	40.00	28.13	31.58	31.76
Income earned by the other farms (%)	0.00	6.25	10.53	7.06

*: Likert Scale: 1 = absolutely not thinking; 2 = Does not think; 3 = Undecided; 4 = Thinking; 5 = definitely thinking

**: Likert Scale: 1 = Very low; 2 = Low; 3 = Medium; 4 = High; 5 = Very high

Source: Own calculation.

In the survey, farmers' total agricultural land was the sum of rented land, owned land and the sharing land.

It was estimated that the number of pieces of agricultural land for farmers was 16.40 parts (Table 2).

The average farmland in interviewed farmers was 11.47 hectares. About 4.04% of this land area could be irrigated, and 95.96% were arid land. The fallow area was 0.63 hectares in average, accounting for 5.48% of the total farmland.

In the average of the farms surveyed, 97.23% of the land with 11.47 hectares of land was composed of owned land, 1.49% of the rented land and 1.28% of the sharing land (Table 2). This situation indicated that the farmers interviewed in the region continued agricultural activities in the property.

In Kütahya province and in the selected region, the rate of irrigated agricultural areas is as low as 2.68%. For this reason, approximately 79.72% of agricultural areas are planted with field crops. Wheat, barley, chickpeas, vetch, clover, sugar beet, sour cherry are important agricultural products.

Table 2. Land property and ownership

Indicators	I	II	III	Average
Parcels numbers (piece)	8.33	12.19	23.13	16.40
Fallow land (ha)	0.57	0.36	0.88	0.63
Owned (ha)	3.79	6.99	17.57	11.15
Rented (ha)	0.00	0.03	0.36	0.17
Sharing (ha)	0.00	0.00	0.33	0.15
Irrigated (ha)	0.30	0.52	0.48	0.46
Arid (ha)	3.49	6.50	17.77	11.01
Total land (ha)	**3.79**	**7.02**	**18.26**	**11.47**
Fallow land (%)	14.96	5.08	4.83	5.48
Owned (%)	100.00	99.55	96.25	97.23
Rented (%)	0.00	0.45	1.95	1.49
Share (%)	0.00	0.00	1.80	1.28
Irrigated (%)	7.92	7.35	2.65	4.04
Arid (%)	92.08	92.65	97.35	95.96
Total land (%)	**100.00**	**100.00**	**100.00**	**100.00**

Source: Own calculation.

The 0-6 age group share was 2.39% of the total family population in the groups' average. About 11.34% of them were in the age group of 7-14 and 48.06% were in the 15-49. The age group over 50 share was 38.21% (Table 3). The age group of 50 and above was 28.55% in the Kütahya province in the year 2013. The 15-49 age group, 0-9 age group, and 10-14 age group share were 52.72%, 12.09%, and 6.64% respectively [21]. Accordingly, there are more elderly people in the rural area. Young generations are trying to look for work in an urban area.

Table 3. Family population by age groups

Age groups	I	II	III	Average
0-6	0.00	3.85	2.33	2.39
7-14	15.25	12.50	9.30	11.34
15-49	55.93	38.46	51.16	48.06
50+	28.81	45.19	37.21	38.21
Total men	47.46	49.04	51.74	50.15
Total women	52.54	50.96	48.26	49.85
Household size	100.00	100.00	100.00	100.00

Source: Own calculation.

In TR33 (Manisa, Afyonkarahisar, Kütahya, Uşak) region, 44.6% of those employed in population aged 15 years and over in 2013 were employed in agriculture and 23.1% in industry. Employment in the services sector was 32.3%. [21] Therefore, agriculture is important in terms of regional economy. The share of employment in agriculture was 23.57% in Turkey.

It was determined that 8.56% was literate, 2.45% was not literate, 44.04% was the primary school, 12.23% was the secondary school, 29.05% was high school and 3.67% was university graduates. According to this, it is found that primary school graduates were more likely to have family members in the region studied. The education level of the third group farmers' family members was higher (Table 4).

The rate of illiteracy for people over age 15 was 4.7% in Turkey, while 95.3% was literate in 2013. In Kütahya, these rates were 3.2% and 96.8% respectively. In 2013, the ratio of the college or faculty graduates of Kütahya to the same age group population was 9.6%. [21] The results of the study were close to the average of Kütahya.

Table 4. Education Level of Family Population

Education level	I	II	III	Average
Be illiterate	0.00	5.00	1.79	2.45
Literate	8.47	10.00	7.74	8.56
Primary school	54.24	47.00	38.69	44.04
Secondary school	11.86	15.00	10.71	12.23
High school	22.03	23.00	35.12	29.05
University	3.39	0.00	5.95	3.67
Total	100.00	100.00	100.00	100.00

Source: Own calculation.

Since chickpea is a summer plant, sowing time is in spring. Suitable time for sowing is between 15 March-30 April for chickpea. [13] In the survey, the farmers did the sowing time of chickpeas in April (37.65%), May (55.29%), and June (7.06%) months.

The amount of chickpea seed applied varies depending sowing method, sowing interval, seed weight of 1,000 and seed germination power per hectare. [13]

Planting methods in chickpea farming are traditional with broadcasting high seed rate by hand and drill. It is recommended that the

seeds amount is to be 150-180 kg. This amount drops to 40-50 kg with drill. [13]

The farmers usually sowed chickpea with sowing machine in the research area. Farmers used as 147.41 kg seed per hectare in the average. This varied between 140.40 kg and 148.30 kg in farmer groups (Table 5).

About 22.35% of the farmers in the region planted traditional methods of broadcasting by hand. This rate was higher in small scale farmers (40%). The 77.65% of the farmers used drill machine for chickpea cultivation.

The farmers in the region applied 9.67 kg of N on average in the cultivation of chickpeas per hectare. It is estimated that the farmers interviewed use 16.92 kg of P on average. K application was 5.04 kg on average per hectare. The third group used the highest NPK (Table 5).

Some herbicides are used before or after sowing in the chemical pathways of weeds in chickpea cultivation [13]. Chickpea growth periods are also affected by many diseases and harmful effects. Anthracnose, Rhizoctonia root rot, Pythium rot, Fusarium wilt, white mould, bacterial blight and some virus diseases are important diseases in chickpea cultivation. However, the most common and most harmful disease in chickpea farming is "anthracnose". Common pests are *Liriomyza cicerina* Rond and *Heliothis viriplaca*. [13]

The 98.82% of the farmers reported that the most important disease was anthracnose problem in the area studied. It was estimated that the herbicide use in the cultivation of chickpea was 666.91 g per hectare in the studied region. Fungicide and insecticide applications were 107.66 g and 58.02 g, respectively, on average. The use of fungicide was greater. The first group farmers did not use fungicide and insecticide in chickpea cultivation (Table 5).

Foliar fertilizer applications were 11.79 kg per hectare. The application of manure was 2.58 kg in average and very low compared to the use of chemical fertilizer (Table 5).

The application of 20-30 kg N and 40-60 kg P fertilizer per hectare brings a considerable increase in chickpea yield [15]. Farmers had low fertilizer application. This situation was also affected by climate conditions that year and soil structures.

Farmers used 11.25 hours machine power on average per hectare in chickpea production. They used 107.39 hours labour on average per hectare. The third group farmers used 107.39 hours labour in chickpea farming. This group was the lowest labour usage. The first group of farmers was the most with labour usage of 384.24 hours per hectare. Family labour force utilization was 61.74 hours a year on average in chickpea agriculture per hectare. This value varied between 58.59 hours and 272.12 hours in the farmers' groups. The use of paid worker was calculated to be 45.64 hours per hectare (Table 5). As the business scale grew, the rate of paid workers increased. As a matter of fact, 57.50% of the total workforce was in the family labour force and 54.99% to 70.82% on the enterprise scale. Therefore, more than half of the workforce employed was provided with family labour in the cultivation of chickpea.

About 52.94% of the farmers in the region used harvesters machine in chickpea harvesting. According to the production scale, harvesting machinery usage increased. The 73.68% of the third group farmers used harvesters.

The yield of chickpea was calculated to be 985.75 kg per hectare. The chickpea yield varied between 862.12 kg and 998.45 kg per hectare in the farmers' groups, with the highest yield in the third group of farmers (Table 5).

The number of registered chickpea varieties in Turkey is 19 [7]. The farmers who were interviewed found that 20.00% of Sarı 98 variety, 36.47% of Hisar, 22.35% of İspanyol and 21.18% of Azkan variety were suitable for regional chickpea farming.

In different ecological conditions, the yield of chickpea is also different. Singh and Saxena [16] reported that the chickpea yield was 1,674 kg per hectare in a 10-year period (1983-1993) at three locations in ICARDA. Azkan et al. [3] found that chickpea yield was 1,682 kg hectare in the Bursa province, Anlarsal et al. [2] determined that chickpea yield was 2,173 kg per hectare in the Çukurova region. Özdemir et al. [13] found that the chickpea yield was 2,670 kg in 10

different types of chickpeas in the Eastern Mediterranean Region. Altınbaş and Sepetoğlu [1] determined chickpea yield ranging values between 1,786 kg and 2,719 kg per hectare in İzmir province. Togay and Togay [19] reported that the yield was 876.2 kg per hectare in Van province. Türk and Koç [23] determined that the yields of domestic chickpea were 1,444 kg, the yield of 995 kg in Diyar-95 variety in Ceylanpınar ecological conditions. Toker and Çancı [20] reported that chickpeas yielded was changed 871-1,676 kg per hectare in Antalya province. Bakoğlu and Ayçiçek [4] determined that the chickpea yield was changed between 497.9-986.7 kg in Bingöl province. Yiğitoğlu [27] reported that chickpea yields were changed between 1,524 kg and 2,457 kg in early winter sowing, 1,235 kg and 2,160 kg per hectare in early spring sowing in Kahramanmaraş province. Yaşar [26] determined that chickpea yields were changed between 1,215 kg to 1,730 kg per hectare in Diyarbakır province. Biçer et al. [5] found that chickpea yields were ranged from 922 kg to 1,954 kg per hectare in winter planting, ranged from 810 kg to 1,403 kg in spring planting in Diyarbakır.

Table 5. Input utilization rates in chickpea farming

Inputs	I	II	III	Average
N usage per hectare (kg)	4.72	8.92	9.82	9.67
P usage per hectare (kg)	8.28	15.61	17.18	16.92
K usage per hectare (kg)	2.44	4.64	5.12	5.04
Seed per hectare (kg)	142.58	140.40	148.30	147.41
Herbicide usage per hectare (g)	212.12	427.34	700.80	666.91
Fungicide usage per hectare (g)	0.00	187.40	99.49	107.66
Insecticide usage per hectare (g)	0.00	129.03	50.29	58.02
Foliar fertilizers usage per hectare (kg)	0.00	16.77	11.34	11.79
Manure usage per hectare (kg)	0.00	3.07	2.55	2.58
Machinery power used per hectare (hour)	36.36	17.11	10.25	11.25
Family labour used per hectare (hour)	272.12	66.97	58.59	61.74
Paid-labour used per hectare (hour)	112.12	54.81	43.76	45.64
Total labour used per hectare (hour)	384.24	121.78	102.35	107.39
Yield of chickpeas per hectare (kg)	862.12	891.24	998.45	985.75

Source: Own calculation.

Chemical fertilizer use rate was 30.59%. The 51.76% of the farmers interviewed also had herbicide application (Table 6). Also Duzdemir et al. [9] found that 59.5% of farmers used chemical fertilizers for chickpea growing in Tokat province. The first 30 to 60 days of the emergence of chickpea plants are the most critical period for weed control [14]. Şanlı et al. [17] reported that most effective for control of weeds was hand hoeing application at the 36th day after crop emergence in Isparta ecological conditions. Şanlı et al. [17] claimed that this application increased the yield of chickpeas by 142% and with this application, the yield was 1,430 kg per hectare. Demir et al. [8] also found that hand hoeing was the most effective for control of weeds, resulting in the highest yield in chickpea throughout in Diyarbakır.

Fungicide (12.94%) and insecticide (4.71%) use rates were low. About 23.53% of the farmers applied foliar fertilizers and 3.53% applied manure. The farmers' production scale increased the use of inputs (Table 6).

Also, the farmers in the region usually used the chickpea-wheat rotation system. However, some farmers in this issue had lack of knowledge.

Table 6. Input usage amounts in chickpea farming

Inputs	I	II	III	Average
Chemical fertilizer usage (%)	13.33	31.25	36.84	30.59
Herbicide usage (%)	20.00	46.88	68.42	51.76
Fungicide usage (%)	0.00	9.38	21.05	12.94
Insecticide usage (%)	0.00	6.25	5.26	4.71
Foliar fertilizers usage (%)	0.00	25.00	31.58	23.53
Manure usage (%)	0.00	3.13	5.26	3.53

Source: Own calculation.

Chickpea is a more extensive agriculture than fruits, vegetables and other industrial plants. The sources of information on input use of chickpea farmers in the research area were also examined. Farmers' answers were taken with the Likert scale of 5. In selecting the inputs, farmers reported that their knowledge and experience were more important. Their experience in input selection, use and preference were important. The result of this study also corroborate with Gül and Parlak [12] and Duzdemir et al.'s [9] findings. In addition, the technical staff' recommendations in the provincial/district directorate of agriculture were important. The result of this study also corroborate with Gül and Parlak [12].

Table 7. Importance of information sources on the input used

Information sources	I	II	III	Average
According to your own knowledge and experience	4.27	4.06	4.24	4.18
Recommendations of technical staff in Provincial Directorate of Agriculture	4.40	4.16	3.87	4.07
Dealer recommendations	3.73	3.88	3.58	3.72
Neighbours and relatives recommendation	3.80	3.78	3.63	3.72
Books, magazines, newspapers, brochures, etc.	3.20	2.84	2.63	2.81
Buyer recommendation (trader)	2.67	2.50	2.37	2.47

5 Likert scale: absolutely no(1), no(2), partly(3), yes(4), absolutely yes(5)

Source: Own calculation.

Dealer's recommendations, neighbours and relatives' recommendation were also found to be important (Table 7).

The problems encountered in the chickpea cultivar in the study area were also examined and the replies given by the farmers were taken with the Likert scale of 5. Farmers expressed the most important problems as high input prices and low chickpea prices. In addition, disease and pests of chickpea farming, breeding techniques, and marketing possibilities/limitations were expressed as important problems (Table 8).

Table 8. Importance level of problems in chickpea farming

Problem areas	I	II	III	Average
High inputs prices	4.00	4.22	4.26	4.20
Low product prices	4.00	4.13	4.11	4.09
Disease and harmful struggle	3.87	4.00	3.89	3.93
On breeding techniques	3.87	3.94	3.89	3.91
Inadequate market and buyer	3.87	3.88	3.79	3.84
Supervision of input vendors	3.27	3.72	4.00	3.76
Fertilizer and fertilizer application	3.53	3.81	3.76	3.74
Providing quality input	3.33	3.88	3.63	3.67
Supply of equipment	3.60	3.41	3.34	3.41
Providing appropriate credit	3.07	3.03	3.26	3.14
Machine use	3.07	2.66	2.68	2.74
Lack of collaboration and organization between producers	2.47	2.72	2.68	2.66

5 likert scale: no problem (1), little problem(2), moderate trouble(3), there is a major problem(4), there is a lot of trouble(5),
Source: Own calculation.

CONCLUSIONS

In this study, farmers' family population, education level, land assets, some social indicators of farmers and technical applications of chickpea cultivation were evaluated in the case of Kütahya province. In addition, farmers' problems encountered in the cultivation of chickpea were determined.

Farmers' age was 50.13 years in the average. Their education level was more than 6 years, and their household size was 3.94. Experiences in chickpea cultivation were 21.28 years on average. This situation showed that chickpea production is important for farmers in this region.

Farmers' use of inputs in chickpea farming was low. The amount of annual rainfall in the region is low and the possibility of irrigation the land is also insufficient. Generally, farmers were farming in the arid land. The number of land parts was high and they farmed in their owned lands. The yield that farmers gain from chickpea cultivation was also low. Climate conditions are also very effective in the production of grown crops in the region. Anthracnose disease, input prices and product prices were the most important problems. These indicate that the cultivation of chickpeas was done in extensive agriculture in the region. Therefore, these criteria also indicate the reasons why the agricultural incomes of producers were low. This leads farmers in search of non-agricultural jobs. As a matter of fact, 31.76% of 85 farmers interviewed were working in non-agricultural jobs.

In terms of sustainability of chickpea cultivation in the region, it is important to share the results of the field work done in arid areas with farmers and to inform rotation system, and the farm management to obtain more efficiency from the unit area.

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