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CROP PRODUCTION

Durum wheat production in Diyarbakır Province of Türkiye: situation analysis and future perspective

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ABSTRACT: This study was to understand, evaluated and analyzed various issues related to durum wheat production. The population of the study consisted of durum wheat producers working in Ergani, Yenişehir, Bismil and Çınar districts of Diyarbakır province. The sample of the study was determined by using simple random sampling method among durum wheat producers operating in Ergani, Yenişehir, Bismil and Çınar districts of Diyarbakır province. In the study, the "sales kg" criterion was reported to be more important than the others. The "Eyyübi" variety was have the highest performance compared to other alternatives. It was also found that producers' priorities in variety selection were resistance/tolerance of the variety to diseases and pests, market selling price and seed price. Türkiye stands out as an important durum wheat producing country. Secondly, the best performing product in Türkiye on the cost-benefit axis is Eyyübi This study was carried out with the financial support of TAGEM. It is declared that there is no conflict of interest.
Key words: durum wheat, production, productivity, Diyarbakır.

Produção de trigo duro na província de Diyarbakır na Turquia: análise da situação e perspectiva futura

RESUMO: O objetivo deste estudo foi compreender, avaliar e analisar diversas questões relacionadas à produção de trigo duro. A população do estudo consistia em produtores de trigo duro que trabalhavam nos distritos de Ergani, Yenişehir, Bismil e Çınar, na província de Diyarbakır. A amostra do estudo foi determinada usando o método de amostragem aleatória simples entre produtores de trigo duro que operam nos distritos de Ergani, Yenişehir, Bismil e Çınar, na província de Diyarbakır. No estudo, o critério "quilo vendas" mostrou-se mais importante que os demais. A variedade "Eyyübi" apresentou o melhor desempenho em comparação com outras alternativas. Verificou-se também que as prioridades dos produtores na seleção das variedades eram a resistência/tolerância da variedade a doenças e pragas, o preço de venda no mercado e o preço da semente. A Turquia se destaca como um importante país produtor de trigo duro. Em segundo lugar, o produto com melhor desempenho na Turquia no eixo custo-benefício é o Eyyübi.
Palavras-chave: trigo duro, produção, produtividade, Diyarbakır.

INTRODUCTION

Pasta is a popular food consumed worldwide because it is nutritious and easy to prepare (MARCONI & CARCEA, 2001). Pasta is recognised as an excellent component of a nutritious diet due to its metabolic accelerating properties. There are also many clinical and scientific studies showing the superiority of pasta over other starchy products (DIB et al., 2018; AGAMA-ACEVEDO et al., 2011). At the same time, durum wheat also stands out for its superior nutritional value, as it contains much higher levels of calcium, iron, magnesium, phosphorus, potassium, zinc and copper compared to bread wheat, brown rice and white rice (MOHAMMADI & HAGHPARAST, 2022).

The raw material of pasta is semolina obtained from a variety of wheat commonly known as durum wheat (*Triticum turgidum* L. subsp. turgidum conv. *durum*) (BOZZINI, 1998). Durum wheat, unlike many other types of wheat, has a harder and denser structure. It is; therefore,considered to be an ideal raw material for pasta production. The grain of durum wheat is called semolina, a coarse-grained flour, and is often used to make products such as pasta and couscous (SISSONS, 2008; LAFIANDRA et al., 2022). Durum wheat is the tenth most important crop worldwide and is grown in three main regions: Mediterranean basin, northern United States and Canada, and desert regions of southwestern United States and northern Mexico (TEDON et al., 2019).

It is observed that there is an increasing trend of pasta consumption in the world. The report published by FORTUNA BUSINESS INSIGHTS (2021) states that the global pasta market size will be USD 43.63 billion in 2021, USD 46.84 billion in 2022 and USD 77.83 billion in 2029, with an estimated growth of 7.52% compound annual growth during 2022-2029. The report also states that the pasta market is growing due to factors such as increasing consumer demand, growing population and changing consumer preferences, and highlights the importance of new product development, increasing brand awareness and market expansion strategies due to raw material price fluctuations and increased competition.

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Türkiye is one of the world's major durum wheat producers. It ranks third in the world in durum wheat production (Ankara Commodity Exchange, n.d.) and its competitiveness in the sector is increasing every year.

In 2021, the area under wheat in Türkiye was 67.4 million decares and the total production was 17.7 million tonnes. On 55.4 million decares, 14.5 million tonnes of bread wheat and 3.2 million tonnes of durum wheat were produced on 12 million decares. Domestic wheat consumption for the 2020-2021 marketing year is 18.9 million tonnes and the sufficiency rate is 259% for durum wheat. Durum wheat is one of the main raw materials for pasta production in the country and is in demand in domestic and foreign markets. In the first 3 months of 2021-2022, Türkiye experienced an increase of 14% in the quantity and about 39% in the value of pasta exports (Ministry of Agriculture and Forestry, 2022). The production of wheat in different areas as durum and bread wheat provides diversity for different quality requirements and uses.

As consumption has increased in recent years, so has competition among pasta producers. Factors such as Türkiye's high productivity and quality standards, strategic geographical location, genetic diversity, producer cooperation and sustainable agricultural practices make Türkiye one of the most important producers of durum wheat and enable Türkiye to achieve a competitive position in the pasta sector.

In order to understand, evaluate and analyse various issues related to durum wheat production, this study discussed farmers' product selection criteria, inputs used, harvesting and marketing processes and opportunities related to durum wheat production. The results of the study will enable us to understand the trends in durum wheat production, the current situation in the sector, market needs and consumer demands, and will provide guidance for the development of policies and strategies for farmers, measures to increase productivity, development of sustainability targets and marketing strategies.

MATERIALS AND METHODS

Model of the study

A cross-sectional model was used in this study. The data obtained were evaluated using multi-criteria decision making methods (Entropy and Aras method).

Data collection instrument of the study

The study used a questionnaire method to collect data. The questionnaire contains structured questions in accordance with the objectives of the research and the research topic. The questions were designed by the researcher.

Population of the SW study

The population of the study consists of durum wheat producers operating in Ergani, Yenişehir, Bismil and Çınar districts of Diyarbakır province. The sample of the study was determined by using simple random sampling method among durum wheat producers operating in Ergani, Yenişehir, Bismil and Çınar districts of Diyarbakır province.

The sample selection process included the following steps:

1. First, the districts (Ergani, Yenişehir, Bismil and Çınar) with the most intensive durum wheat production in Diyarbakır province were identified. This selection was made considering the objectives of the study, the research topic and the representativeness of the sample.

2. Then, the number of durum wheat producers operating in each district was determined. This number was obtained from the Directorates of Agriculture and Village Affairs, Chambers of Agriculture and other sources in the districts.

3. A total sample size of 86 was determined. This sample size was determined by considering factors such as the purpose of the research, time and resource constraints. The sample was determined using the formula below.

n = N/(1+N(e)2.

The variables in this formula are:

n = the sample size.

N = the population of the study.

e = the margin error in the calculation (YAMANE, 1967).

4. Finally, simple random sampling was used to select a certain number of durum wheat producers from each district. Random sampling is a method in which each producer has an equal chance of being selected and increases the representativeness of the sample group.

Analyses used in the Study

The analyses of the study were carried out in two stages. First, the data were collected through questionnaires and the statistical properties of the data, such as measures of central tendency (mean and median), measures of dispersion (standard deviation, minimum and maximum) and number of data (n), were obtained using SPSS (Statistical Package for the Social Sciences). Secondly, the A new additive ratio assessment (ARAS) method, which is one of the Multiple Criteria Decision Making methods (ZAVADKAS et al., 2010) (MCDM), and the Entropy method were used to weight the criteria.

Application steps of entropy method

1. Creating the Decision Matrix: In the entropy method, the decision matrix is first created as in the other MCDM methods.

$$\begin{bmatrix} x_{01} & \cdots & x_{0j} & \cdots & x_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{j1} & \cdots & x_{ij} & \cdots & x_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{j} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

i = 0,1 ,..., m; j = 0,1 ,…., n

x is the decision matrix, m is the number of alternatives and n is the number of criteria.

2. Normalisation (R) of the Decision Matrix: To eliminate the effects of different index dimensions on the non-equivalence in the decision matrix, the indices are standardized with using different techniques.

$$R_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \; \forall \, i,j \quad (2)$$

3. Calculation of entropy value for each criterion:

$$e_{j=-k} \sum_{j=1}^{n} r_{ij}.\ln(r_{ij}) \quad (3)$$

(i = 1…, m; J= 1,…,n)

Here, ln represents the natural logarithm and k = 1/ ln represents a constant calculated from m, which guarantees that $0 \leq e_j \leq 1$.

4. Calculation of the degree of differentiation dj of the information provided by J:

$$d_j = 1 - e_j \quad (4)$$

j = 1,2,....n

dj indicates the intensity of contrast inherent in an attribute X_j. For an X_j, a higher value of d_j is calculated for more different performance outputs (r_{ij}).

5. Calculation of entropy criteria weight: Entropy criteria weights are calculated using the following formula

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \quad (5)$$

The criterion with a larger Entropy weight is more significant for decision making/evaluation. This is because the Entropy weight measures the degree of useful information, as previously stated.

Application steps of aras method

1. Creating the decision matrix: The decision matrix used in the entropy method was used.

$$\begin{bmatrix} x_{01} & \cdots & x_{0j} & \cdots & x_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{j1} & \cdots & x_{ij} & \cdots & x_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{j} & \cdots & x_{mn} \end{bmatrix} \quad (6)$$

i=0,1 ,..., m j=0,1 ,…., n

x is the decision matrix, m is the number of alternatives and n is the number of criteria.

2. Normalisation (R) of the decision matrix: Since the performance value of x_{0j} criteria in the $\overline{x}$ matrix is preferred to be high, the following formula is used.

$$\overline{x}_{ij} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}} \quad (7)$$

3. Creation of weighted normalised decision matrix: For the weighted normalized decision matrix, criterion weights wj determined by entropy method were used.

$$\hat{x}_{ij} = \overline{x}_{ij}.w_{ij} \quad (8)$$

According to the formula, w_j is the weight (importance) of criterion j and x_{ij} is its weighted normalised value.

4. Calculation of optimality function value: The last step, the optimality function value, is calculated with the following formula.

$$\sum_{j=1}^{n} \hat{x}_{ij} \quad i = 0, 1 \ldots, m \quad (9)$$

The Si value in the formula is the optimality function value of alternative i. The highest value in Si value means the best and the lowest value means the worst. The ratio of the Si values of the alternatives to the optimal function value S_0 gives the degree of utility Ki and is calculated by the following formula:

$$K_i = \frac{S_i}{S_0}, \quad i = 0, 1, .., m \quad (10)$$

The Ki value takes a value in the range [0, 1]. With the calculated Ki values, the relative utility of the alternatives is calculated and finally these values are ranked from highest to lowest and the decision alternatives are evaluated.

Strengths of the tudy

1. Regional coverage: The fact that the study was conducted in Ergani, Yenişehir, Bismil and Çınar districts of Diyarbakır province provides a detailed and regional view of durum wheat producers in these regions.

2. Sample size: The fact that the study was conducted with a sample of 86 respondents is important for the reliability of the statistical analyses and the strength of the results. A large sample makes the results of the study more reliable and excludable.

3. Survey method: Multi-criteria decision making allows for more accurate and comprehensive results by analysing different factors.

4. Potential application areas: The results of the study can be used in potential application areas such as durum wheat producers, agricultural policies and marketing strategies. The results of the study can be instructive for stakeholders in the agricultural sector and provide useful information for policy makers, producers, traders and other interested parties.

5. Innovative approach: The strengths of the study include an innovative approach in areas

such as the methodology used, the analysis of the data or the interpretation of the results.

Weaknesses of the study

1. Time and resource constraints: The time and resource constraints in which the study is conducted may include limitations in areas such as sample size, data collection process, analysis methods and interpretation of results.

2. Conjunctural Causes: Economic, social, political or environmental conditions at the time of the study may have an influence on the results.

RESULTS

Categorical and descriptive statistics of the study

In the district variable, the highest frequency was observed in Çınar and Ergani districts, and these two districts make up the sample with a total of 63.9%. Yenişehir district is represented with only 8.1%. In the educational level variable, the highest frequency is at primary school level (47.7%), followed by secondary school (15.1%) and high school (16.3%). The number of participants at university level is limited to only 7 (8.1%). In the health insurance variable, the highest frequency (77.9%) is found in the Agricultural Bağkur. The shares of the pension fund and the social security institution were found to be 8.1% and 14% respectively. In the durum wheat variety variable, the highest frequency was observed in the Fırat 93 variety (17.4%). The varieties Eyyübi (18.6%) and Sarıbaşak (10.5%) also had high frequencies. The frequencies of the varieties Güney Yıldızı, Local Variety, Artuklu, Zühre, Svevo, Mirzabey, Ege, Cesare, Ovido and Burgos were 1. In the variable land type, the frequency of barren and irrigated land is equal (50%). This shows that land type is evenly distributed in the sample (Table 1).

The average age of farmers is 49. The minimum age is 30 and the maximum age is 72. The average amount of product obtained by the farmers per decare is 247.87 kg. The minimum amount of

Table 1 - Categorical variables obtained in the study and their distributions.

		----------Frequency----------	----------Percent----------
Districts	Çınar	29	33.7
	Ergani	26	30.2
	Yenişehir	7	8.1
	Bismil	24	27.9
Education	Literate	9	10.5
	Primary School	41	47.7
	Middle School	13	15.1
	High School	14	16.3
	Associate Degree	2	2.3
	University	7	8.1
Health Assurance	Agriculture Bağkur	67	77.9
	Pension Fund	7	8.1
	SSI	12	14
Durum Wheat Varieties	Sarıçanak	9	10.5
	Güney Yıldızı	3	3.5
	Yerel Çeşit	4	4.7
	Zivago	9	10.5
	Fırat 93	15	17.4
	Artuklu	2	2.3
	Zühre	6	7
	Svevo	1	1.2
	Sarıbaşak	9	10.5
	Mirzabey	1	1.2
	Eyyübi	16	18.6
	Ege	1	1.2
	Cesare	8	9.3
	Ovido	1	1.2
	Burgos	1	1.2
Land Type	Kirac	43	50
	Watery	43	50

product is 10 kg and the maximum amount of product is 842 kg. The average amount of product obtained per hectare is 503.20 kg. The minimum product quantity is 250 kg and the maximum product quantity is 750 kg. The average amount of product sold to traders is 120497,96 kg. The minimum quantity sold is 3000 kg and the maximum quantity sold is 553000 kg. The average selling price of products sold to traders is 1.21 TL/kg. The minimum selling price is 0.98 TL/kg and the maximum selling price is 1.60 TL/kg. Finally, the average experience of farmers in durum wheat production is 18 years. The minimum experience period is 2 years and the maximum experience period is 50 years (Table 2).

Analysing the means, the respondents consider the importance of the variety's resistance/ tolerance to diseases and pests as the most important factor (mean 4.70). This factor is followed by the market selling price of the variety ($\bar{X}$= 4.67) and the seed price of the variety ($\bar{X}$= 4.66) (Table 3).

Calculation of criteria weights by entropy method

In this study, the Entropy method was used as the criterion weighting method.

Step 1: Creating the decision matrix.

The decision matrix was constructed using equation (1). The rows of the decision matrix represent the 'criteria' for the purpose of the decision problem (Table 4).

Step 2: Normalisation of the decision matrix.

Since all criteria were calculated according to different scales, normalisation process was performed, i.e. conversion to the same unit of measurement. The normalised decision matrices are presented in table 5.

Step 3: Calculation of entropy value for each criterion.

Entropy values have been calculated for all criteria. The entropy values for the criteria are presented in table 6.

Step 4: Calculation of entropy criteria weight with degree of differentiation of information dj.

Table 2 - Descriptive statistics of the study.

	---------1--------	---------2--------	---------3--------	---------4--------	---------5--------	---------6--------
Mean	49	247.87	503.20	120,497.96	1.21	18
Median	50	160.50	550.00	79,625	1.20	20
Std. Deviation	9	204.34	148.58	116,829.82	20	9
Minimum	30	10	250	3,000	98	2
Maximum	72	842	750	553,000	1.60	50
N	86	86	86	86	81	84

1: Age; 2. Decare; 3. Product Received (kg/ha); 4. Sale to Trader (kg); 5. Sale to Trader (TL); 6. Farmers' Experience in Durum Wheat Production (Years).

Table 3 - Participants' level of participation in factors affecting the selection of durum wheat variety.

	---------Mean--------	---Std. Deviation---
High yield is important	4.54	1.018
It is important that the variety is of good quality	4.64	722
The market selling price of the variety is important	4.67	717
It is important that the variety is easy to market	3.70	1,030
I prefer the bread of the variety I am used to	3.38	916
It is important that the variety is resistant/tolerant to diseases and pests	4.70	.679
The seed price of the variety is important for my choice of variety	4.66	1.051
When choosing a variety, the advice of the place where I bought the seed is important	3.46	881
I prefer varieties with readily available seed	3.56	970
The rotational characteristic of the variety is important	4.64	708

Table 4 - Entropy method decision matrix.

Type	----Product Received (kg/da)----	----------Sales (kg)----------	----------Sales (TL)----------
Sarıçanak	3750	310,800	1.06
Güney Yıldızı	1650	66,000	1.13
Yerel Çeşit	1575	95,500	1.10
Zivago	4300	656,400	1.10
Fırat 93	8850	848,250	1.24
Artuklu	1280	291,125	1.30
Zühre	3490	629,250	1.015
Svevo	600	65,000	1.05
Sarıbaşak	4300	1,347,300	1.42
Mirzabey	350	45.500	1.20
Eyyübi	7300	2,867,150	1.25
Ege	550	275,000	1.50
Cesare	3900	2,339,050	1.155
Ovido	650	126.,00	1.02
Burgos	730	400,000	1.1

The anthropometric values *ej* were subtracted from 1 and the degree of differentiation *dj* was calculated. Using equation (5), the importance levels of the criteria were determined by the 'enropy weights' obtained by dividing the degrees of differentiation by the sum of the degrees. Accordingly, the criterion with the highest importance level is "sales kg".

Aras Method Multiple Decision Making Results

The Aras method, one of the CRM methods, was used to analyse the data used in the study. The steps of the method are as follows:

Step 1: Creating the decision matrix:

The same decision matrix used in the Entropy method was used. The rows of the decision matrix represent the "criteria" for the purpose of the decision problem (Table 7, Table 8).

The normalisation step according to the benefit and cost index, unlike the entropy method, calculates the optimal value according to the maximum and minimum values (Table 9, Table 10).

Step 2: Normalisation of the decision matrix.

Using Equation (7), the matrix x_{0j} was normalized by dividing the matrix x_{0j} by the sum of

Table 5 - Normalised decision matrix.

Type	---Product Received (kg/da)---	----------Sales (kg)----------	----------Sales (TL)----------
Sarıçanak	0.086655113	0.0299918	0.05996095
Güney Yıldızı	0.03812825	0.0063689	0.06424387
Yerel Çeşit	0.036395147	0.0092156	0.06235435
Zivago	0.099364529	0.0633418	0.06235435
Fırat 93	0.204506066	0.0818551	0.07029036
Artuklu	0.029578278	0.0280932	0.0736915
Zühre	0.080647025	0.0607219	0.05753606
Svevo	0.013864818	0.0062724	0.05952006
Sarıbaşak	0.099364529	0.1300128	0.0804938
Mirzabey	0.008087811	0.0043907	0.06802293
Eyyübi	0.168688619	0.2766765	0.07085721
Ege	0.012709417	0.0265372	0.08502866
Cesare	0.090121317	0.2257155	0.06547207
Ovido	0.01502022	0.0122071	0.05781949
Burgos	0.016868862	0.0385995	0.06235435

Table 6 - Entropy values for criteria.

Type	---Product Received (kg/da)---	----------Sales (kg)----------	----------Sales (TL)----------
Sarıçanak	-0.211942744	-0.105176	-0.1687338
Güney Yıldızı	-0.124557359	-0.032203	-0.1763539
Yerel Çeşit	-0.120588763	-0.043192	-0.1730284
Zivago	-0.229428731	-0.174773	-0.1730284
Fırat 93	-0.324583365	-0.204867	-0.1866294
Artuklu	-0.104136689	-0.100355	-0.1921777
Zühre	-0.203042866	-0.170109	-0.1642852
Svevo	-0.059319247	-0.031811	-0.1679324
Sarıbaşak	-0.229428731	-0.265242	-0.2028102
Mirzabey	-0.038962196	-0.023834	-0.1828395
Eyyübi	-0.300215263	-0.355503	-0.1875653
Ege	-0.055481841	-0.096309	-0.2095758
Cesare	-0.216885831	-0.335973	-0.1784855
Ovido	-0.063060259	-0.053781	-0.1648104
Burgos	-0.068863516	-0.125623	-0.1730284

Table 7 - Entropy value degree of differentiation (d_j) and Entropy Value (Importance).

e_j	0.867966702	0.7823908	0.99750159
d_j	0.132033298	0.2176092	0.00249841
w_j	0.374944491	0.6179606	0.00709492

Table 8 - Aras method decision matrix.

Type	---Product received (kg/da)---	----------Sales (kg)----------	----------Sales (TL)----------
Sarıçanak	3750	310,800	1.06
Güney Yıldızı	1650	66,000	1.13
Yerel Çeşit	1575	95,500	1.10
Zivago	4300	656,400	1.10
Fırat 93	8850	848,250	1.24
Artuklu	1280	291,125	1.30
Zühre	3.490	629,250	1.015
Svevo	600	65,000	1.05
Sarıbaşak	4300	1,347,300	1.42
Mirzabey	350	45,500	1.20
Eyyübi	7300	2,867,150	1.25
Ege	550	275,000	1.50
Cesare	3900	2,339,050	1.155
Ovido	650	126,500	1.02
Burgos	730	400,000	1.1

Table 9 - Criterion weights and aspects.

	Aras Method Decision Matrix	Sales (kg)	Sales (TL)
A	+	+	+
W	0.374944491	0.617961	0.007095

the values of each x_{ij} and the matrix $\bar{x}_{ij}$ was formed (Table 11).

Step 3: Obtaining the weighted normalised decision matrix (xij).

The "weighted normalised decision matrix" was obtained by multiplying the calculated optimal values and the importance levels of the calculated criteria with the entropy value and the weighting levels calculated earlier (Table 12).

Step 4: Calculation of optimality function (Si) and utility degree (Ki).

Optimal function values Si were calculated by summing the weighted normalised decision matrix values xij for each column of each criterion. Utility was calculated by dividing the calculated optimal function values Si by the optimal function value $S0$. The performance of the alternatives was evaluated by ranking the calculated utility values Ki from highest to lowest. Accordingly, "Eyyübi" ranked first with the best optimal value of 0.186896 and a utility degree of 0.943261 (94%) (Table 13).

DISCUSSION

Türkiye is one of the top 10 durum wheat producing countries in the world. It is very important to study yield statistics at provincial and district level, to identify production trends and to determine producer behaviour in terms of continuity and yield.

Educated farmers are more aware and knowledgeable about issues such as farming techniques, irrigation methods, seed selection, fertilisation, disease and pest control. This means higher productivity, less wastage and higher quality produce. At the same time, educated farmers can more easily adopt innovations in the agricultural sector and develop more sustainable agricultural practices (CHAUDHRI, 2022; ASADULLAH & RAHMAN, 2009). In the study, the high frequency of respondents with primary education level indicates that most of the workers in the agricultural sector have low level of education, while the low number of respondents with university education level indicates that the number of highly educated people in the agricultural sector is limited. This situation shows that policies should be developed to increase the number of educated workers in the agricultural sector. It also shows that agricultural policies should address not only technical factors such as production efficiency and product quality, but also socio-economic factors.

Workers in agriculture should have healthy and safe working conditions. This is because there are various risks to which workers in agriculture are

Table 10 - Decision matrix for determining optimum values.

Type	---Product received (kg/da)---	----------Sales (kg)----------	----------Sales (TL)----------
w	0.374944491	0.617961	0.007095
Optimum	8850	2,867,150	1.5
Sarıçanak	3750	310,800	1.057778
Güney Yıldızı	1650	66,000	1.133333
Yerel Çeşit	1575	95,500	1.1
Zivago	4300	656,400	1.1
Fırat 93	8850	848,250	1.24
Artuklu	1280	291,125	1.3
Zühre	3490	629,250	1.015
Svevo	600	65,000	1.05
Sarıbaşak	4300	1,347,300	1.42
Mirzabey	350	45,500	1.2
Eyyübi	7300	2,867,150	1.25
Ege	550	275,000	1.5
Cesare	3.900	2,339,050	1.155
Ovido	650	126,500	1.02
Burgos	730	400,000	1.1

Table 11 - Normalisation of thedecision matrix.

Type	---Product received (kg/da)---	----------Sales (kg)----------	----------Sales (TL)----------
w	0.374944491	0.617961	0.007095
Optimum	0.169784173	0.216716	0.078365
Sarıçanak	0.071942446	0.023492	0.055262
Güney Yıldızı	0.031654676	0.004989	0.059209
Yerel Çeşit	0.030215827	0.007218	0.057468
Zivago	0.082494005	0.049615	0.057468
Fırat 93	0.169784173	0.064116	0.064782
Artuklu	0.024556355	0.022005	0.067917
Zühre	0.066954436	0.047562	0.053027
Svevo	0.011510791	0.004913	0.054856
Sarıbaşak	0.082494005	0.101837	0.074186
Mirzabey	0.006714628	0.003439	0.062692
Eyyübi	0.140047962	0.216716	0.065304
Ege	0.010551559	0.020786	0.078365
Cesare	0.074820144	0.176799	0.060341
Ovido	0.012470024	0.009562	0.053288
Burgos	0.014004796	0.030234	0.057468

exposed (BENDIXSEN et al., 2023; DABROWSKA-MICIULA & DE LIMA, 2020). These include chemical, biological, physical, psychosocial, climatic and mechanical risks. In addition, a healthy and safe working environment for agricultural workers increases productivity and improves the quality of production. A healthy and safe working environment is also important for the sustainability of farms. The study shows that the majority of those involved in durum wheat cultivation are covered by Agricultural Bağkur. Agricultural Bağkur is a social security institution that provides social security to those working in the agricultural sector. This result showed that the durum wheat cultivation sector is generally composed of small farmers and that these farmers have an important place in the social security system. However, the low

Table 12 - Weighted normalised matrix.

Type	---Product received (kg/da)---	----------Sales (kg)----------	----------Sales (TL)----------
w	0.374944491	0.617961	0.007095
Optimum	0.06365964	0.133922	0.000556
Sarıçanak	0.026974424	0.014517	0.000392
Güney Yıldızı	0.011868746	0.003083	0.00042
Yerel Çeşit	0.011329258	0.004461	0.000408
Zivago	0.030930673	0.03066	0.000408
Fırat 93	0.06365964	0.039621	0.00046
Artuklu	0.00920727	0.013598	0.000482
Zühre	0.025104197	0.029392	0.000376
Svevo	0.004315908	0.003036	0.000389
Sarıbaşak	0.030930673	0.062931	0.000526
Mirzabey	0.002517613	0.002125	0.000445
Eyyübi	0.052510212	0.133922	0.000463
Ege	0.003956249	0.012845	0.000556
Cesare	0.028053401	0.109255	0.000428
Ovido	0.004675567	0.005909	0.000378
Burgos	0.005251021	0.018684	0.000408

Table 13 - Optimality function, utility and ranking.

Type	Product received (kg/da)	Sales (kg)	----Sales (TL)----	---------Si---------	---------Ki---------	
Optimum	0.06365964	0.133922	0.000556	0.198138	1	
Sarıçanak	0.026974424	0.014517	0.000392	0.041884	0.211387	7
Güney Yıldızı	0.011868746	0.003083	0.00042	0.015372	0.077581	12
Yerel Çeşit	0.011329258	0.004461	0.000408	0.016198	0.08175	11
Zivago	0.030930673	0.03066	0.000408	0.061998	0.312905	5
Fırat 93	0.06365964	0.039621	0.00046	0.10374	0.523577	3
Artuklu	0.00920727	0.013598	0.000482	0.023287	0.117531	9
Zühre	0.025104197	0.029392	0.000376	0.054872	0.276939	6
Svevo	0.004315908	0.003036	0.000389	0.007741	0.03907	14
Sarıbaşak	0.030930673	0.062931	0.000526	0.094388	0.476377	4
Mirzabey	0.002517613	0.002125	0.000445	0.005088	0.025677	15
Eyyübi	0.052510212	0.133922	0.000463	0.186896	0.943261	1
Ege	0.003956249	0.012845	0.000556	0.017357	0.087602	10
Cesare	0.028053401	0.109255	0.000428	0.137737	0.695155	2
Ovido	0.004675567	0.005909	0.000378	0.010962	0.055327	13
Burgos	0.005251021	0.018684	0.000408	0.024342	0.122856	8

rates of the Pension Fund and the Social Security Institution may mean that workers in this sector are not sufficiently protected in terms of social security. This suggested that efforts should be made to provide better social security opportunities for workers in the sector.

Proper crop selection is an important factor in successful crop production. Whatever the purpose of farming, it is important to be able to select a crop and variety with broad resistance to important pests and diseases. The use of susceptible varieties can result in high production costs or complete crop failure (BHARGAVA & SRIVASTAVA, 2019; MIKESELL, 1995). The study reported that producers' priorities in selecting varieties were resistance/tolerance of the variety to diseases and pests, market selling price and seed price. This information shows that producers taketobaccount not only financial gains but also long-term factors such as disease and pest resistance when making decisions. These results can help determine the factors that producers should consider when selecting varieties for durum wheat production.

The study found that the "kilograms sold" criterion was more important than the others. This result shows the importance of product sales in durum wheat production. Sales kg of product is a very important factor in agricultural production. Sales kg play an important role in determining the income of the producer. In addition, sales kg reflect the demand for the product and its competitiveness on the market (FAO, 2023; OECD, 2023; BARRETT & JUST, 2022).

In agricultural production, crop selection is a very important issue to obtain the most product with the least input in production (ALMACA, 2014; ALVAREZ & BERG, 2019). In this study, as a result of this evaluation using optimal function values and utility degrees, it was found that the variety "Eyyübi" had the highest performance compared to other alternatives. This result will help wheat farmers to have an idea about which variety to prefer. At the same time, it will make it easier for farmers to choose between different varieties to be used in agricultural production, and the farmers' choice of the right variety will bring benefits in terms of higher productivity, higher quality and less exposure to diseases and pests.

CONCLUSION

This study emphasized the importance of Türkiye in durum wheat production and addressed issues such as education level, social security, product selection and marketing strategies in the agricultural sector. The results reveal the importance of increasing the educated labor force in the agricultural sector, improving social security opportunities, promoting the use of disease and pest resistant seeds, and raising awareness on product sales. It also indicates that wheat farmers' selection of the right variety is of great importance in terms of productivity and product quality. The findings of this study suggest that agricultural policies should not only deal with technical factors but also with socio-economic factors. These

recommendations can contribute to the development of policies and practices to increase the sustainability and competitiveness of durum wheat producers in Türkiye.

Suggestions

1. Low levels of education can make it difficult for farmers to adopt modern technologies and best agricultural practices. Therefore, training support may be provided to farmers.

2. The fact that agricultural Bağkur has the highest frequency of health insurance indicates that agricultural workers are protected in terms of social security. Although this protection is higher than that of other occupational groups, efforts can be made to increase the rates of other social security institutions.

3. It is important for farmers to give importance to resistant/tolerant varieties against diseases and pests in terms of product efficiency and quality. Therefore, support can be provided to make resistant and quality seeds more accessible to farmers.

4. The identification of sales kg as the most important criterion indicates that farmers should have more knowledge about preparing their products for sale and marketing. Therefore, training support can be provided to farmers on marketing and sales.

5. The fact that variety "Eyyübi" has the highest degree of utility indicates that this variety is more productive than other varieties. Promoting this variety more and encouraging farmers can increase productivity.

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DECLARATION OF CONFLICT OF INTEREST

There is no conflict of interest in this study.

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