Selcuk Journal of Agriculture and Food Sciences

Determination of Factors Affecting Wheat Production in Altınekin District by Risk Analysis

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ARTICLE INFO	ABSRACT
	In this study, it is aimed to determine minimum and maximum risk ranges of farmer and insurance in terms of natural risk factors affecting wheat yield in Altınekin district of Konya. Diseases and pests and other risk factors outside the scope of insurance were included in the linear model and the yield was estimated for all natural risks for wheat production at the district level. As natural risk factors, diseases and pests, frost, drought, hail, fire and other risks and interactions of factors were taken. In this study, 63 different linear models were formed by factor number and minimum and maximum risk intervals were determined by using simplex method of linear programming on yield and price basis. In the model with all risk factors and interactions, the expected risk value of the farmer was estimated to be 81.696 (kg×ha^{-1}) – 90.029 (TL×ha^{-1}) while it was estimated as 60.241 (kg×ha^{-1}) – 66.385 (TL×ha^{-1}) in terms of insurance.

1. Introduction

It is recognized that a country's agricultural development level is equivalent in that it obtains more than a self-contained amount of agricultural products. Wheat farming is a strategic agricultural product that can be cultivated in every region of the world in terms of soil requirements and climate requirements (Kızılaslan, 2004). It is an agricultural product with high economic competitiveness due to its high adaptability. As it is a basic product used in human nutrition, it has maintained its importance throughout history. Because of the decrease in agricultural areas and productivity, migration from village to city, increasing costs, etc., gaining more quantity than unit area is gaining importance every day. The use of varieties that are compatible with ecology has gained importance in increasing the production (Çağlar, 2006).

The two main factors affecting the yield obtained from living material are genotype and environment. The fact that the quantitative characteristics reflect the genotype capacity depends on the formation of appropriate environmental conditions (Düzgüneş & Akman, 1995). The main factors affecting agricultural production are soil, seed, human and climate (Şimşek & Çakmak, 2010). While soil, seed and human are considered as macro environmental factors, climate can be defined as micro environmental factor because it is a mechanism that human beings cannot intervene.

Although agricultural technique and technology develop, climate factors continue to affect the yield (Kapluhan, 2013).

In recent years, global warming and natural disasters in the world, as well as other agricultural products, such as wheat cultivation are at great risk. Although there are many factors affecting the yield, the biggest share belongs to the natural risk factors. Natural risk factors commonly include diseases and pests, frost, drought, hail, fire, earthquake, storm, hose, landslide, flood and other risks. While the control of natural risk factors from climatic conditions is almost impossible, it is possible in part to detect the use of early warning systems thanks to advance technology. These events, which occur outside the control of the growers, cause fluctuations in the production of agricultural products. These fluctuations in productivity cause economic concern of the farmer (Akçaöz et al 2006).

The irregularity of the yields of agricultural products has led producers to seek an assurance of sustainability. It is inevitable that the agricultural products produced under risk are covered by insurance and their losses are partially covered. In this context, the Agricultural Insurance Law was enacted in 2005 after private insurance companies were active in Turkey. In 2006, the agricultural insurance pool and its activities began TARSİM (Sümer & Polat, 2016).

In this study, it is aimed to determine the minimum and maximum risk intervals in terms of farmers and insurance by making risk analysis of the factors affecting wheat production in Altınekin district.

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2. Materials and Methods

Altınekin district, which is located as the continuation of the Konya plain extending to the north of Konya, is located at 38.307777 latitude and 32.868610 longitude (Figure 1). The altitude is 985 m, annual precipitation amount is 422 mm and face measurement is 1165.3 km^2. The characteristics of the continental climate in Altınekin are similar to the terrestrial climate type of Eastern Anatolia, rather than the continental climate type of Central Anatolia (Anonymous, 2018).

Figure 1
Map of Altinekin district of Konya (Anonymous, 2018)

The probability, frequency and corrected probability values of the risk factors and their interactions in Altınekin district, wheat production were determined by the experts in the light of meteorological data. The probability values of the interactions are the probability of occurrence of two or more events at the same time, it is calculated as $P(A)xP(B)x ... xP(n)$. In the calculation of the risk frequencies of the interactions, the average of the relevant risk factors was taken (Table 1). In addition, the effects of the risk factors and their interactions in wheat production were determined by the local farmers, agricultural engineers and academicians who are experts in this field (Table 2).

Risk analysis is mainly divided into two basic components: probability and effect. Since the effect of time will lead to a change in risk, the frequency of the risk should be included in the calculation. In simple terms, risks; $Risk = (PR \times RF) \times ER$ is calculated (Erdoğan, 2017). In other words, risk;

$Risk = APR \times ER$ is also calculated (PR: Probability of Risk, RF: Frequency of Risk, ER: Effect of Risk, APR: Adjusted Probability of Risk).

The possibility of risk, the probability of occurrence of risk factor, the effect occurs when the risk occurs when the risk factor that shows how positive or negative effects that make doing. The frequency of the risk is the coefficient that shows the average severity of the risk in time. Risk frequencies in the study consist of values between 0-3. The value of 0 indicates that there is no risk frequency, whereas the value of 3 indicates that the risk factor is always occurring.

In the study, the frequencies of the risks were taken as the coefficients of the constraints and helped to calculate the risks in the temporal sense as a weighted average.

In the creation of linear programming and its stages, the following mathematical expressions were performed. The objective function is designed as a multi-factor linear model that varies according to the number of factors.

Objective function;

$$Max(Min)Z(x) = CX$$

Constraints;

$$AX \{\leq, =, \geq\} B$$

Positivity requirement;

$X \geq 0$ this is expressed in the form. In this place;

$$C = [c_1, \ c_2, ..., c_n],$$

$$X = \begin{bmatrix} x_1 \\ x_2 \\ . \\ . \\ . \\ x_n \end{bmatrix},$$

$$A = \begin{bmatrix} a_{11} a_{12} \ ... a_{1n} \\ a_{21} a_{22} \ ... a_{2n} \\ . \quad . \quad \quad . \\ . \quad \quad . \quad \quad . \\ . \quad \quad . \ ... \ . \\ a_{m1} a_{m1} \ ... a_{mn} \end{bmatrix},$$

$$B = [b_1, b_2, ..., b_m]^T = \begin{bmatrix} b_1 \\ b_2 \\ . \\ . \\ . \\ b_m \end{bmatrix},$$

C: (1 x n) dimensional objective function coefficients vector (Adjusted Probability of Risk),

X: (n x 1) dimensional decision variables vector (Risk Factors and Interactions),

A: (m x n) dimensional constraint coefficients matrix (Frequency of Risk),

B: (m x 1) is the vector of the values of the dimensional constraints (Effect of Risk).

Analysis of the created linear models in this study were obtained with the help of the GAMS package program version 24.1.3.CPLEX algorithm version 12.5.1.0.

Table 1
Frequencies and Probability of Natural Risks Which are Taken in Wheat Production of Altinekin District, Konya

Natural Risks	Symbols	Risk Probability		Risk Frequency		Adjusted Risk Probability	
		Min	Max	Min	Max	Min	Max
Diseases and Pests	x1	0.08	0.15	1.350	2.000	0.108	0.3
Frost	x2	0.10	0.20	1.250	1.750	0.125	0.35
Drought	x3	0.065	0.36	1.600	2.450	0.104	0.882
Hail	x4	0.01	0.05	1.250	1.400	0.0125	0.07
Fire	x5	0.001	0.003	1.050	1.100	0.00105	0.0033
Others	x6	0.10	0.20	1.500	1.850	0.15	0.37
Diseases and Pests- Frost	x12	0.008	0.03	1.300	1.875	0.0104	0.05625
Diseases and Pests- Drought	x13	0.0052	0.054	1.475	2.225	0.00767	0.12015
Diseases and Pests- Hail	x14	0.008	0.075	1.300	1.700	0.0104	0.1275
Diseases and Pests- Fire	x15	0.00008	0.00045	1.200	1.550	0.000096	0.0006975
Diseases and Pests- Others	x16	0.008	0.03	1.425	1.925	0.0114	0.05775
Frost- Drought	x23	0.0065	0.072	1.425	2.100	0.0092625	0.1512
Frost- Hail	x24	0.001	0.01	1.250	1.575	0.00125	0.01575
Frost- Fire	x25	0.0001	0.0006	1.150	1.425	0.000115	0.000855
Frost- Others	x26	0.01	0.04	1.375	1.800	0.01375	0.072
Drought- Hail	x34	0.0065	0.018	1.425	1.925	0.0092625	0.03465
Drought- Fire	x35	0.000065	0.000108	1.325	1.775	0.000086125	0.0001917
Drought- Others	x36	0.0065	0.072	1.550	2.150	0.010075	0.1548
Hail- Fire	x45	0.0001	0.0015	1.150	1.250	0.000115	0.001875
Hail- Others	x46	0.001	0.10	1.375	1.625	0.001375	0.1625
Fire - Others	x56	0.001	0.006	1.275	1.475	0.001275	0.00885
Diseases and Pests- Frost- Drought	x123	0.00052	0.0108	1.400	2.067	0.000728	0.02232
Diseases and Pests- Frost- Hail	x124	0.00008	0.0015	1.283	1.717	0.000102667	0.002575
Diseases and Pests- Frost- Fire	x125	0.000008	0.00009	1.217	1.617	0.00000973	0.0001455
Diseases and Pests- Frost- Others	x126	0.0008	0.006	1.367	1.867	0.001093333	0.0112
Diseases and Pests- Drought- Hail	x134	0.000052	0.0027	1.400	1.950	0.0000728	0.005265
Diseases and Pests- Drought- Fire	x135	0.0000052	0.000162	1.333	1.850	0.00000693	0.0002997
Diseases and Pests- Drought- Others	x136	0.00052	0.0108	1.483	2.100	0.000771333	0.02268
Diseases and Pests- Hail- Fire	x145	0.0000008	0.00002	1.217	1.500	0.00000097	0.00003
Diseases and Pests- Hail- Others	x146	0.00008	0.0015	1.367	1.750	0.000109333	0.002625
Diseases and Pests- Fire- Others	x156	0.000008	0.00009	1.300	1.650	0.0000104	0.0001485
Frost- Drought- Hail	x234	0.000065	0.0036	1.367	1.867	0.00008883	0.00672
Frost- Drought- Fire	x235	0.0000065	0.000216	1.300	1.767	0.00000845	0.0003816
Frost- Drought- Others	x236	0.00065	0.0144	1.450	2.017	0.0009425	0.02904
Frost-- Hail- Fire	x245	0.000001	0.00003	1.183	1.417	0.00000118	0.0000425
Frost- Hail- Others	x246	0.0001	0.002	1.333	1.667	0.000133333	0.0033333
Frost- Fire- Others	x256	0.00001	0.00012	1.267	1.567	0.00001267	0.000188
Drought- Hail- Fire	x345	0.00000065	0.000054	1.300	1.650	0.000000845	0.0000891
Drought- Hail- Others	x346	0.000065	0.0036	1.450	1.900	0.00009425	0.00684
Drought- Fire- Others	x356	0.0000065	0.000216	1.383	1.800	0.00000899	0.0003888
Hail- Fire- Others	x456	0.000001	0.00003	1.267	1.450	0.00000127	0.0000435
Diseases and Pests- Frost- Drought- Hail	x1234	0.0000052	0.00054	1.363	1.900	0.000007085	0.001026
Diseases and Pests- Frost- Drought- Fire	x1235	0.00000052	0.00003	1.313	1.825	0.00000068	0.00005475
Diseases and Pests- Frost- Drought- Others	x1236	0.000052	0.00216	1.425	2.013	0.0000741	0.004347
Diseases and Pests- Frost- Hail- Fire	x1245	0.00000008	0.000005	1.225	1.563	0.000000098	0.00000781
Diseases and Pests- Frost- Hail- Others	x1246	0.000008	0.0003	1.338	1.750	0.0000107	0.000525
Diseases and Pests- Frost- Fire- Others	x1256	0.0000008	0.000018	1.288	1.675	0.00000103	0.00003015
Diseases and Pests- Drought- Hail- Fire	x1345	0.000000052	0.000008	1.313	1.738	0.00000007	0.0000139
Diseases and Pests- Drought- Hail- Others	x1346	0.0000052	0.00054	1.900	2.567	0.00000988	0.001386
Diseases and Pests- Drought- Fire- Others	x1356	0.00000052	0.00003	1.375	1.850	0.000000715	0.0000555
Diseases and Pests- Hail- Fire- Others	x1456	0.00000008	0.000005	1.288	1.588	0.000000103	0.00000794
Frost- Drought- Hail- Fire	x2345	0.000000065	0.00001	1.288	1.675	0.00000008	0.00001675
Frost- Drought- Hail- Others	x2346	0.0000065	0.00072	1.400	1.863	0.0000091	0.001341
Frost- Drought- Fire- Others	x2356	0.00000065	0.00004	1.350	1.788	0.00000088	0.0000715
Frost- Hail- Fire- Others	x2456	0.0000001	0.000006	1.263	1.525	0.00000013	0.00000915
Drought- Hail- Fire- Others	x3456	0.000000065	0.00001	1.350	1.700	0.00000009	0.00001700
Diseases and Pests- Frost- Drought- Hail-Fire	x12345	0.000000005	0.000002	1.300	1.740	0.00000001	0.00000348
Diseases and Pests- Frost- Drought- Hail- Others	x12346	0.00000052	0.000108	1.390	1.890	0.00000072	0.0002041
Diseases and Pests- Frost- Drought- Fire- Others	x12356	0.000000052	0.000006	1.350	1.830	0.00000007	0.00001098
Diseases and Pests- Frost- Hail- Fire- Others	x12456	0.000000008	0.0000009	1.280	1.620	0.00000001	0.00000146
Diseases and Pests- Drought- Hail-Fire- Others	x13456	0.000000005	0.000002	1.350	1.760	0.00000001	0.00000352
Frost- Drought- Hail-Fire- Others	x23456	0.000000007	0.000002	1.330	1.710	0.0000000093	0.00000342
Diseases and Pests-Frost- Drought-Hail-Fire-Others	x123456	0.0000000005	0.0000003	1.333	1.758	0.0000000007	0.00000053

Table 2
Effect of Natural Risks Which are Taken in Wheat Production of Altınekin District, Konya

Natural Risks	Symbols	Effect of Risks for Farmer (kg×ha^{-1})		Effect of Risks for Insurance (kg×ha^{-1})	
		Min	Max	Min	Max
Diseases and Pests	x1	40	100	0	0
Frost	x2	10	90	20	50
Drought	x3	40	135	70	70
Hail	x4	10	125	15	55
Fire	x5	15	400	25	280
Others	x6	20	140	60	45
Diseases and Pests- Frost	x12	25	145	45	85
Diseases and Pests- Drought	x13	45	165	85	90
Diseases and Pests- Hail	x14	30	135	45	85
Diseases and Pests- Fire	x15	50	400	75	280
Diseases and Pests- Others	x16	50	180	85	115
Frost- Drought	x23	45	170	60	110
Frost- Hail	x24	20	145	25	95
Frost- Fire	x25	20	400	30	280
Frost- Others	x26	45	170	75	110
Drought- Hail	x34	40	150	60	100
Drought- Fire	x35	55	400	80	280
Drought- Others	x36	60	180	90	120
Hail- Fire	x45	20	400	30	280
Hail- Others	x46	45	185	65	120
Fire - Others	x56	50	400	75	280
Diseases and Pests- Frost- Drought	x123	65	250	100	150
Diseases and Pests- Frost- Hail	x124	40	210	60	130
Diseases and Pests- Frost- Fire	x125	45	400	70	280
Diseases and Pests- Frost- Others	x126	65	235	95	140
Diseases and Pests- Drought- Hail	x134	60	240	90	140
Diseases and Pests- Drought- Fire	x135	65	400	95	280
Diseases and Pests- Drought- Others	x136	70	250	105	150
Diseases and Pests- Hail- Fire	x145	40	400	55	280
Diseases and Pests- Hail- Others	x146	50	260	75	155
Diseases and Pests- Fire- Others	x156	65	400	95	280
Frost- Drought- Hail	x234	60	240	95	145
Frost- Drought- Fire	x235	65	400	100	280
Frost- Drought- Others	x236	70	250	110	150
Frost- Hail- Fire	x245	25	400	40	280
Frost- Hail- Others	x246	55	215	80	125
Frost- Fire- Others	x256	50	400	70	280
Drought- Hail- Fire	x345	60	400	85	280
Drought- Hail- Others	x346	70	235	100	130
Drought- Fire- Others	x356	90	400	120	280
Hail- Fire- Others	x456	55	400	80	280
Diseases and Pests- Frost- Drought- Hail	x1234	90	275	115	135
Diseases and Pests- Frost- Drought- Fire	x1235	95	400	120	280
Diseases and Pests- Frost- Drought- Others	x1236	100	265	135	130
Diseases and Pests- Frost- Hail- Fire	x1245	90	400	115	280
Diseases and Pests- Frost- Hail- Others	x1246	65	290	100	140
Diseases and Pests- Frost- Fire- Others	x1256	105	400	155	280
Diseases and Pests- Drought- Hail- Fire	x1345	90	400	120	280
Diseases and Pests- Drought- Hail- Others	x1346	95	300	145	155
Diseases and Pests- Drought- Fire- Others	x1356	110	400	160	280
Diseases and Pests- Hail- Fire- Others	x1456	95	400	115	280
Frost- Drought- Hail- Fire	x2345	90	400	115	280
Frost- Drought- Hail- Others	x2346	90	245	120	125
Frost- Drought- Fire- Others	x2356	100	400	135	280
Frost- Hail- Fire- Others	x2456	75	400	95	280
Drought- Hail- Fire- Others	x3456	95	400	130	280
Diseases and Pests- Frost- Drought- Hail-Fire	x12345	95	400	125	280
Diseases and Pests- Frost- Drought- Hail- Others	x12346	95	260	135	140
Diseases and Pests- Frost- Drought- Fire- Others	x12356	130	400	180	280
Diseases and Pests- Frost- Hail- Fire- Others	x12456	100	400	130	280
Diseases and Pests- Drought- Hail-Fire- Others	x13456	125	400	170	280
Frost- Drought- Hail-Fire- Others	x23456	95	400	130	280
Diseases and Pests-Frost- Drought-Hail-Fire-Others	x123456	120	400	150	280

3. Results and Discussion

Based farmer and insurance minimum and maximum risk ranges are given in Table 3 in terms of yield (kg×ha^{-1}) and price (TL×ha^{-1}) as a result of risk analysis of natural risk factors and interactions taken for wheat yield in Altınekin district. While the farmer wants to pay the minimum amount of insurance premium, there are differences between the minimum risk amounts determined by the insurance (Table 3). These differences are closed as premium support is offered in terms of some risk factors. 50% of the premium, 66.67% of the frost cover and 60% of the drought is under the state guarantee (Çiftçi, 2014). It is only slightly lower than the farmers' expectations due to the fact that the district-based natural risk factors are not implemented outside the drought and the disease pests and other risk factors are excluded from the collateral.

The created models offer the possibility of selecting the natural risks that the farmer wants with the help of linear programming. In this way, the farmer may be willing to pay less money by insuring some of the factors he considers risky for his own purposes. A similar situation is actually applied in vehicle insurance. For example, in a location where there is no flood or earthquake hazard, vehicle owners cannot cover these risks and thus lower the amount they will pay.

When considering all risk factors for wheat yield, it is 16.236 - 147.155 (kg×ha^{-1}) and 17.892 - 162.165 (TL×ha^{-1}) for the farmer but it is between 19.241 - 101.24 (kg×ha^{-1}) and 21.204 - 111.566 (TL×ha^{-1}) for the insurance (Table 3). The expected average risk value for the farmer is estimated as 81.696 (kg×ha^{-1}) – 90.029 (TL×ha^{-1}) and the insured 60.241 (kg×ha^{-1}) – 66.385 (TL×ha^{-1}).

4. Conclusions

The most difficult part of risk analysis is to determine the effect of risks. Utilization of climatic data to estimate the yield of Agroshell, Apes, Cropsyst, Daisy, Dssat, Fasset, Hermes, Stics, Wofost, as well as modules, as well as using satellite imagery to estimate the efficiency of the farmer and insurance will help to evaluate healthier (Palosuo et al, 2011).

While trying to achieve maximum security by paying farmers a minimum premium within the framework of the logic of linear programming, insurance companies are working to provide the minimum cost by taking maximum premium. Stakeholders should not be burdened in economic terms by meeting in the middle point.

5. Acknowledgements

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Table 3
Results of Farmer and Insurance Risk Analysis in Wheat Production of Altinekin District, Konya

Natural Risks	Symbols	Farmer Risk (kg/ha^{-1})		Insurance Risk (kg/ha^{-1})		Farmer Risk (*TL/ha^{-1})		Insurance Risk (*TL/ha^{-1})	
		Min	Max	Min	Max	Min	Max	Min	Max
Diseases and Pests	x1	4.320	30.000	0.000	0.000	4.761	33.060	0.000	0.000
Frost	x2	1.250	31.500	2.500	17.500	1.378	34.713	2.755	19.285
Drought	x3	4.160	119.070	7.280	61.740	4.584	131.215	8.023	68.037
Hail	x4	0.125	8.750	0.188	3.850	0.138	9.643	0.207	4.243
Fire	x5	0.016	1.320	0.026	0.924	0.017	1.455	0.029	1.018
Others	x6	3.000	51.800	9.000	16.650	3.306	57.084	9.918	18.348
Diseases and Pests- Frost	x12	4.400	30.600	4.360	12.550	4.849	33.721	4.805	13.830
Diseases and Pests- Drought	x13	6.034	62.010	5.967	30.060	6.649	68.335	6.576	33.126
Diseases and Pests- Hail	x14	3.540	26.875	0.810	9.125	3.901	29.616	0.893	10.056
Diseases and Pests- Fire	x15	3.219	16.080	0.081	0.966	3.547	17.720	0.089	1.065
Diseases and Pests- Others	x16	5.600	41.033	8.680	14.550	6.171	45.218	9.565	16.034
Frost- Drought	x23	3.893	64.040	6.940	39.494	4.290	70.572	7.648	43.522
Frost- Hail	x24	1.120	22.200	2.175	13.200	1.234	24.464	2.397	14.546
Frost- Fire	x25	1.017	19.170	2.028	10.858	1.121	21.125	2.235	11.966
Frost- Others	x26	4.950	40.800	8.750	23.400	5.455	44.962	9.643	25.787
Drought- Hail	x34	2.960	52.050	5.090	28.500	3.262	57.359	5.609	31.407
Drought- Fire	x35	2.619	49.438	4.580	25.860	2.886	54.481	5.047	28.498
Drought- Others	x36	4.990	70.560	11.135	42.840	5.499	77.757	12.271	47.210
Hail- Fire	x45	0.117	7.675	0.178	3.845	0.129	8.458	0.196	4.237
Hail- Others	x46	2.295	48.750	6.215	23.750	2.529	53.723	6.849	26.173
Fire - Others	x56	2.080	31.180	6.100	11.385	2.292	34.360	6.722	12.546
Diseases and Pests- Frost- Drought	x123	7.560	88.300	9.794	50.150	8.331	97.307	10.793	55.265
Diseases and Pests- Frost- Hail	x124	4.763	45.240	4.950	22.320	5.249	49.854	5.455	24.597
Diseases and Pests- Frost- Fire	x125	4.421	31.821	4.420	13.559	4.872	35.067	4.871	14.942
Diseases and Pests- Frost- Others	x126	8.802	61.710	11.866	30.240	9.700	68.004	13.076	33.324
Diseases and Pests- Drought- Hail	x134	6.637	76.233	7.172	40.113	7.314	84.009	7.904	44.205
Diseases and Pests- Drought- Fire	x135	6.057	63.003	6.054	30.892	6.675	69.429	6.672	34.043
Diseases and Pests- Drought- Others	x136	8.860	92.070	14.312	52.770	9.764	101.461	15.772	58.153
Diseases and Pests- Hail- Fire	x145	3.561	28.458	0.894	10.352	3.924	31.361	0.985	11.408
Diseases and Pests- Hail- Others	x146	6.139	70.665	9.311	33.807	6.765	77.873	10.261	37.255
Diseases and Pests- Fire- Others	x156	5.685	42.676	8.812	14.986	6.265	47.029	9.711	16.515
Frost- Drought- Hail	x234	4.276	70.604	7.511	45.892	4.712	77.806	8.277	50.573
Frost- Drought- Fire	x235	3.913	65.945	6.974	41.889	4.312	72.671	7.685	46.162
Frost- Drought- Others	x236	8.278	97.199	14.346	64.320	9.122	107.113	15.809	70.881
Frost- Hail- Fire	x245	1.139	13.317	2.206	14.351	1.255	14.675	2.431	15.815
Frost- Hail- Others	x246	5.121	61.430	8.998	38.526	5.643	67.696	9.916	42.456
Frost- Fire- Others	x256	5.017	42.208	8.854	25.862	5.529	46.513	9.757	28.500
Drought- Hail- Fire	x345	2.981	30.215	5.123	29.505	3.285	33.297	5.646	32.515
Drought- Hail- Others	x346	5.550	83.356	11.746	57.858	6.116	91.858	12.944	63.760
Drought- Fire- Others	x356	5.074	61.750	11.241	45.106	5.592	68.049	12.388	49.707
Hail- Fire- Others	x456	2.377	52.407	6.318	26.398	2.619	57.753	6.962	29.091
Diseases and Pests- Frost- Drought- Hail	x1234	8.191	104.625	10.785	60.568	9.026	115.297	11.885	66.746
Diseases and Pests- Frost- Drought- Fire	x1235	7.586	89.562	9.860	51.123	8.360	98.697	10.866	56.338
Diseases and Pests- Frost- Drought- Others	x1236	12.438	132.494	18.016	75.487	13.707	146.008	19.854	83.187
Diseases and Pests- Frost- Hail- Fire	x1245	4.802	44.443	5.012	21.605	5.292	48.976	5.523	23.809
Diseases and Pests- Frost- Hail- Others	x1246	9.220	92.992	12.535	50.314	10.160	102.477	13.814	55.446
Diseases and Pests- Frost- Fire- Others	x1256	8.879	64.912	12.002	32.738	9.785	71.533	13.226	36.077
Diseases and Pests- Drought- Hail- Fire	x1345	6.662	77.139	7.261	39.948	7.342	85.007	8.002	44.023
Diseases and Pests- Drought- Hail- Others	x1346	9.667	125.396	15.344	74.062	10.653	138.186	16.909	81.616
Diseases and Pests- Drought- Fire- Others	x1356	8.949	95.342	14.450	55.121	9.862	105.067	15.924	60.743
Diseases and Pests- Hail- Fire- Others	x1456	6.226	72.030	9.446	34.019	6.861	79.377	10.409	37.489
Frost- Drought- Hail- Fire	x2345	4.314	74.581	7.548	45.667	4.754	82.188	8.318	50.325
Frost- Drought- Hail- Others	x2346	8.717	126.166	14.998	75.359	9.606	139.035	16.528	83.046
Frost- Drought- Fire- Others	x2356	8.350	104.756	14.457	66.647	9.202	115.441	15.932	73.445
Frost- Hail- Fire- Others	x2456	5.195	65.061	9.105	39.415	5.725	71.697	10.034	43.435
Drought- Hail- Fire- Others	x3456	5.636	96.343	11.856	59.730	6.211	106.170	13.065	65.822
Diseases and Pests- Frost- Drought- Hail-Fire	x12345	8.234	108.189	10.854	63.047	9.074	119.224	11.961	69.478
Diseases and Pests- Frost- Drought- Hail- Others	x12346	16.128	169.036	19.094	98.014	17.773	186.278	21.042	108.011
Diseases and Pests- Frost- Drought- Fire- Others	x12356	15.54	136.316	18.159	78.279	17.125	150.220	20.011	86.263
Diseases and Pests- Frost- Hail- Fire- Others	x12456	12.295	99.203	12.675	54.759	13.549	109.322	13.968	60.344
Diseases and Pests- Drought- Hail-Fire- Others	x13456	9.759	131.465	15.486	77.739	10.754	144.874	17.066	85.668
Frost- Drought- Hail-Fire- Others	x23456	11.819	98.342	15.111	71.903	13.025	108.373	16.652	79.237
Diseases and Pests-Frost- Drought-Hail-Fire-Others	x123456	16.236	147.155	19.241	101.24	17.892	162.165	21.204	111.566

*The unit price of wheat kilogram is taken as 1.102 TL