Analysis of Developments in Plant Production in the Governorates of the Asir Region, Saudi Arabia

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Abstracts

Plant production is diverse in the Asir region, and there are many methods of analysis. Perhaps factor analysis is one of the most important statistical methods through which productive power can be measured in various geographical regions. In this study, factor analysis was used to measure the developments of plant production in the agricultural sector in the Asir region, Saudi Arabia. The factor analysis showed the presence of three main factors that together explained about %86.55 of the total variation in the development of plant production in the governorates of the Asir region. The study showed three mathematical algorithms that can measure the development of plant production in the Asir region according to the three main factors:

First factor equation

λ1=44.250%=-0.521*X_1 0.810*X_2+0.78*X_3+0.842*X_4+0.755*X_5

Second factor equation

λ2=24.960%-0.228*X_1+0.352*X_2+0.936*X_3-0.226*X_4-0.380*X_5

The third factor equation

λ3=17.344%0.796*X_1+0.291*X_2+0.104*X_3+0.339*X_4-0.153*X_5

-The study classified the governorates of the Asir region, based on the results of the analysis, into three groups, according to negative and positive 0.933-0.975 and includes Bisha - Abha - Ahad Rafaida - Khamis Mushait - in Al-Furn - Al-Barak, while the second group represents the category of 0.897-0.548 and includes the governorates of Mahayel, Asir - Tanmomah - Al-Namas - Tathleeth. The third group includes the category of 0.255--0234 and includes the governorates Sarat Ubaidah - Al-Majadra and Bariq - Tareeb - Dhahran Al-Janoub and Al-Harajah - Rijal Almaa

Keywords: Saudi Arabia, Asir region, plant production, factor analysis.

Introduction

The agricultural sector consists of plant crops, animal crops, and fish production, and production quantities vary between these components in the Asir region. This study is interested in knowing the possibility of measuring plant production in the governorates of the Asir region. Using modern methods of analysis, which is factor analysis using the SPSS program and recording the results using the ARC GIS programs. The development of plant production is an important focus in the agricultural development plans of all countries in the world, especially in developing countries. There are many variables to measure developments in plant production, such as the production of various grain crops, the production of fruits, the production of protected and outdoor vegetables, as well as the production of fodder.

2- Study problem: The study problem is to answer the following questions:

1. Is it possible to measure developments in plant production between the governorates of the Asir region?
2. What are the most important statistical methods for measuring developments in plant production in the Asir region?
3. What is the ranking of the governorates of the Asir region in plant production?

3- Study objectives: The study aims to:

1. Knowing the plant productive power of the governorates of the Asir region 2020 AD.
2. Explaining the method of factor analysis to measure developments in plant production in the Asir region.
3. Clarifying the ranking of the governorates of the Asir region in terms of plant production quantities.

4. Study methodology and tools: The methods used in the study are multiple, and they are:

1- The analytical approach to analyzing developments in plant production in the governorates of the Asir region.
2- Using the factor analysis method in the (SPSS) program as one of the statistical methods to measure developments in plant production in the governorates of the Asir region.
3- Use ARC.GIS programs to draw maps and sign the results.

5-Data source:
The Ministry of Environment, Water, and Agriculture in the Kingdom of Saudi Arabia provides statistical data on agriculture in all regions of the Kingdom, in addition to special publications on the crop structure in the Asir region from a branch of the Ministry of Environment, Water, and Agriculture.

6 -Importance of the study: The importance of the study is as follows:

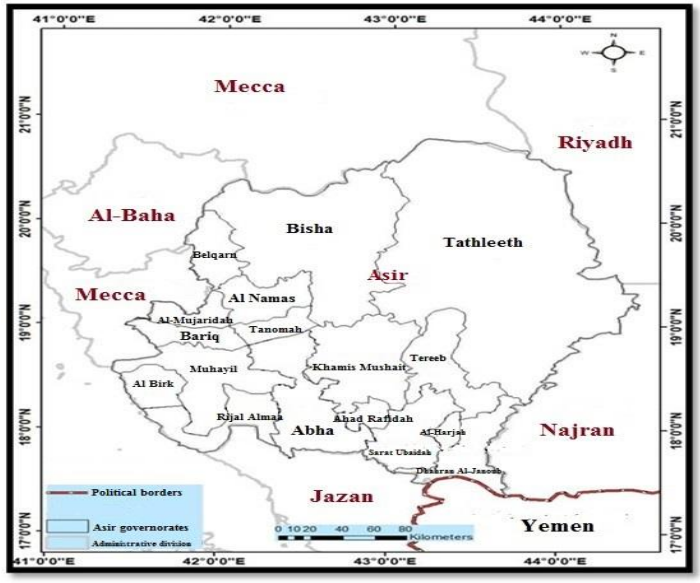
1. The developmental and economic importance of studying developments in plant production in the governorates of the Asir region.
2. Invite researchers to use the factor analysis method to measure developments in plant production in different geographical regions.
3. Study the subject from a geographical perspective using modern statistical programs.

7- Previous studies: There are many previous studies that dealt with practical analysis as a measure of analysis, including a study (Omar, 2016) entitled Factor analysis of the foundations of development in Kordofan State, and a study (Bshara, 2012) dealt with the use of factor analysis to determine the factors affecting the gross domestic product, as well as Another study (Yasser, 2006) dealt with the title: Global analysis and geographical distribution of economic activity in Assiut Governorate. Another study also dealt with the analysis of regional development possibilities in Sudan using global and cluster analysis (Sumi, 2015). While the study (Abbas, 2015) addressed agricultural patterns in Maysan Governorate using two cluster factor analysis techniques, as did the study (Fadhl, 2019) entitled Factor analysis to measure economic development in Arabian Peninsula countries.

8 -Study area:

The Asir region is located between latitudes 17.25°-19.50° north, and longitudes 50°-50.41° east. Geographically, it is located in the southwestern part of the Kingdom of Saudi Arabia. It is bordered to the north by the regions of Mecca and Al-Baha, to the east by the Najran region and part of the Riyadh region, to the south by the Jazan region and part of the Republic of Yemen, and to the west by the Red Sea. The Asir region includes a number of governorates, the most important of which are: Abha, Khamis Mushayt, Al-Namas, Bisha, Mahayil, Tathleeth, Sarat Ubaidah, Rijal Alma', Ahad Rufaidah, Dhahran Al-Janoub, Al-Majaridah, Belqarn, Barq, Al-Barak, Tanumah, Al-Harjah, Tarib, and Abha, the headquarters of the emirate. The geographical area of the Asir region is 81,000 km2, Fig. (1). (General Secretariat of Asir Region, 2020). The population of the Asir region is 2,261,618 people (General Authority for Statistics, 2020).

Fig (1) Location of the study area.



Source: Researchers' work based on GIS program.

9 -Definition of factor analysis:

Factor analysis is one of the most important statistical methods. The first person to use factor analysis was the scientist (Spermay, 1904), and it was developed by the scientist (Hoteling, 1933), then it was used in the applied field by the two scientists (Kipp and Lmbie, 1971).

Factor analysis is known as a multivariate analysis method that is concerned with dealing with a group of variables with the aim of highlighting the relationship between them and a particular phenomenon. Factor analysis depends on the correlation coefficients between the elements. It is also known as (a method of multivariate statistical analysis), and factor analysis describes and interprets the phenomena or characteristics of the variables on the basis of reaching the highest degree of information with the least number of factors, which express the relationships that exist between the variables in a linear or non-linear function. (Omar, 2016, p.34).

Geographical research has benefited from factor analysis due to the distinct characteristic of geography, whose studies depend on dozens of natural, human, and economic variables and hundreds of cases that are linked to each other through complex relationships. Therefore, factor analysis is a tool. Mathematical statistics help geographical researchers simplify these relationships and condense their variables into a few axes or factors. They also help geographers derive and identify prominent patterns in their geographical dimensions and determine how geographical phenomena spread (Al-Sirani, 2000, p. 425).

It can be said that the factor analysis method helps to reduce the volume of data (Data Reduction), and it is also considered an important classification tool in the field of geographical research. Factor analysis depends on the data matrix (data table) collected by the researcher about the phenomena to be measured and analyzed, and works to summarize the multiple manifestations through the many variables that the researcher monitored. Factor analysis condenses the data and large numbers of variables into a small number of factors.

Many mathematical and statistical equations are used in factor analysis, perhaps the most important of which are:

A.

Xi = f (fi , fii , …….. + N) UI

Where XI = value of element 1

fi, fii….. + N = value of factor values

UI = Univariate of determinant 1

Using this equation, We get :

1 -Estimating sample values, which are the indicators that are used to determine the factors that were chosen as basic factors.

2-Identify the main elements of each element by testing the elements whose values range from 0.5 and above.

3- Rotating the factors with the aim of obtaining simple structures for the model matrix whose coefficients are easy to interpret and clear from a matrix that is difficult to interpret (Al-Sirani, 2000, 425).

B.

$$Z = \frac{Xi - m}{S}$$

Where Z = standard value

X = singleton value

m = arithmetic means for the indicator

S = standard deviation

The previous equations are used manually to extract ratios and conduct analysis, and they require a long time, accuracy, and concentration. The researcher may be exposed to errors and find it difficult to apply them, and to avoid mistakes that the researcher may make, With the development of the information and technology revolution at the end of the twentieth century and the beginning of the twenty-first century, many statistical computer programs appeared, which can be used to conduct accurate statistical analyses, enter data, save and store it, and display and draw various graphical forms. Perhaps the most important of these programs is (SPSS). This is what concerns the theoretical aspect.

10- The applied aspect: with the aim of measuring developments in plant production in the governorates of the Asir region. The researcher chose five indicators in Table (1) as a standard for measuring developments in plant production compared to sixteen governorates in the Asir region. Table (2) shows the values of these indicators for the sixteen governorates that were chosen.

Table (1) Plant production in the governorates of the Asir region, 2020

N	Governorate	Grain Crops	Open vegetable crops	Protected vegetable crops	Protected vegetable crops	Fruit crops	Fodders	Total
		Production	Production	Production	Production	Production	Production	
1	Abha	3888.4	2947.4	9136.5	9136.5	7482.0	315.5	23769.8
2	Khamis Mushait	446.9	4618.5	2454.4	2454.4	6816.0	346.4	14682.2
3	Sarat Obeida	551.1	970.0	1931.5	1931.5	2148.8	254.6	5856.0
4	Bisha	697.7	5468.8	0	0	62953.3	1689.6	70809.4
5	Rijal Almaa	1595.2	495.5	0	0	2295.4	27.1	4413.2
6	Mahayil Asir	6332.1	889.5	0	0	790.8	0	8012.4
7	Tareeb	111.3	760.6	986.8	986.8	2373.4	401.4	4633.5
8	Tathleeth	102.2	1240.8	0	0	2584.3	2130.0	6057.3
9	Dhahran Al Janoub and Al-Harjah	553.8	489.2	566.8	566.8	3030.1	260.3	4900.2
10	Al-Majaridah and Barq	717.4	573.6	0	0	4099.6	31.5	5422.1

11	Ahad Rufaidah	23.6	3160.4	16373.4	16373.4	1898.1	80.3	21535.9
12	Tanmomah	1103.6	3588.0	692.9	692.9	1573.0	252.0	7209.5
13	Al Namas	822.0	1513.0	218.5	218.5	4023.0	0	6576.5
14	Al Birk	8211.5	104.2	0	0	0	0	8315.6
15	Belqarn	1877.0	740.5	1938.0	1938.0	5505.8	332.0	0
Total		27033.8	27560	34298.8	34298.8	107573.6	6120.7	192193.6

Source: Kingdom of Saudi Arabia, Ministry of Environment, Water and Agriculture, 2020, Study of the Development and Development of the Crop Structure of the Regions of the Kingdom of Saudi Arabia (First Phase), Asir Region, pp. 1-30.

Table (2) Indicators chosen to measure productive power.

N	Indicator	symbol in analysis	Selection year
1	Quantity of production of various grain crops (wheat - millet - barley - Sorghum - Levantine corn - sesame - other grains)	X1	2020
2	Quantity of production of open vegetable crops	X2	2020
3	Quantity of production of protected vegetable crops	X3	2020
4	Quantity of fruit crop production	X4	2020
5	Quantity of fodder crops production	X5	2020

Source: Worked by researchers based on the SPSS program.

In a later step, the indicators in Table (2) were converted to standard values (Z-Score) for the purposes of completing the analysis, by using equation (b) in the theoretical framework, and then using practical analysis (Factor Analysis) and using (SPSS) program for the purpose of showing how they are distributed. The indicators that were chosen, and after applying the program steps, the result was the emergence of three basic factors whose sample values (Eigen value) are greater than one and explain (86.556%) of the total variance. This confirms the correctness of the researcher's choice of the variables that represent the analysis to measure productive power.

Table (3) and Fig. (2) and (3) show the coefficients of the indicators in the three main factors whose loadings are greater than or equal to (0.5).

Table (3) Indicator coefficients on the three basic factors.

Variables	First factor	Second factor	Third factor
X_1	-0.521	-0.228	0.796
X_2	0.810	0.352	0.291
X_3	0.078	0.936	0.104
X_4	0.842	-0.226	0.339
X_5	0.755	-0. 380	-0.153
Variance for each factor	% 44.250	% 24.960	% 17.344
Total variation	86.556 %		

Source: Worked by researchers based on the SPSS program

Fig. (2) Indicator coefficients on the three basic factors

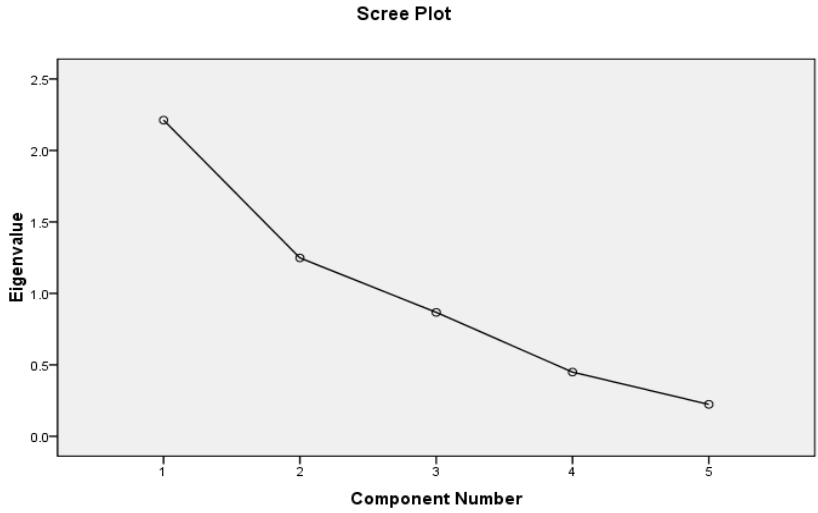
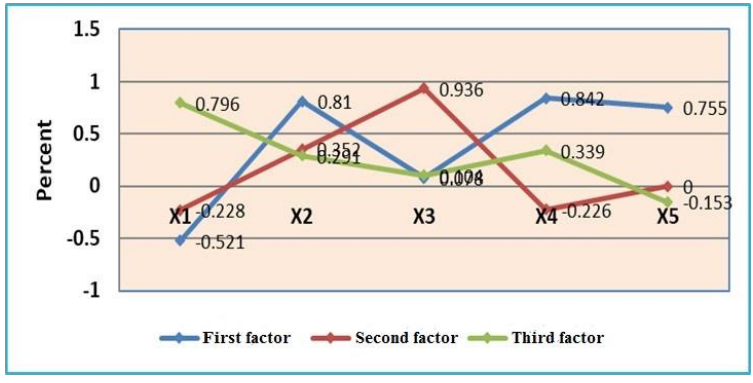


Fig. (3) Indicators of the three basic factors



Source: Figure created by the researcher based on Table (3)

By analyzing the results of Table (3), it can be said that the first factor indicates the elements of plant production for various grain crops, fruits and fodder, as it explained a total of 44.250% of the variance and combines the following variables:

1. Quantity of production of open vegetable crops x2
2. Quantity of fruit crop production x4

3. Quantity of fodder crops production x5

These variables are the basis of the direct relationship to the development of plant production in the Asir region. The greater the interest in producing fodder fruits and vegetables, the better productivity. In light of scale (5), we can achieve the development of plant production for the governorates of the Asir region under study by applying a new equation as follows:

$$\lambda 1=44.250\%=-0.521*X\_1\ 0.810*X\_2+0.78*X\_3+0.842*X\_4+0.755*X5$$

The second factor indicates open and protected vegetable crops, as it explained a total of (24.960%) of the variance and collects the following changes:

1. Quantity of production of protected vegetable crops x3

These variables have taken negative values, confirming their impact on the development of plant production in the governorates of the Asir region in the countries concerned. Through the table, we can measure the development of plant production for the governorates of the Asir region under study with the following equation:

$$\lambda 2=24.960\%-0.228*X\_1+0.352*X\_2+0.936*X\_3-0.226*X\_4-0.380*X5$$

The third factor indicates the various grain crops in the sixteen governorates of the Asir region, as it collects the variables.

1. Quantity of production of various grain crops (wheat - millet - barley - sorghum - maize - sesame - other grains) x1

The production of various grain crops is one of the most used indicator variables to measure the level of development achieved in the governorates of the Asir region.

Through the table, we can measure the development of grain production in the Asir region under study with the following new equation:

$$\lambda 3=17.344\%=0.796*X\_1+0.291*X\_2+0.104*X\_3+0.339*X\_4-0.153*X5$$

To measure the development of plant production in each governorate according to negative and positive variables and the direct impact on production, recycling was used on the way to be analyzing the variables of Table (1), which led to Table (4), which shows the levels of the governorates of the Asir region under study, where the Factor Score was calculated. For each governorate and for each of the three basic factors, using the (SPSS) program, Table (4) was produced.

Table (4) Degree of availability of factors in the governorates of the Asir region

Governorate	First factor	Second factor	Third factor
Abha	.548	-.472	.690
Khamis Mushait	.897	-.175	-.135
Sarat Obeida	.776	-.503	.378
Bisha	.975	.144	-.102

Rijal Almaa	.721	.645	.255
Mahayil Asir	-.234	.797	.543
Tareeb	.970	-.230	-.047
Tathleeth	.566	.137	-.770
Dhahran Al Janoub and Al-Harjah	.981	.130	.039
Al-Majaridah and Barq	.958	.276	-.014
Ahad Rufaidah	-.044-	-.867	.494
Tanmomah	.225	.067	-.234
Al Namas	.955	.240	-.062
Al Birk	-.333	.749	.573
Belqarn	.933	.116	.293

Source: The table was created by researchers based on SPSS

To show the productivity of each governorate, a map was drawn that provides a classification for these governorates. Using the SPSS program, we obtained the ranking of the governorates in Table (5) .

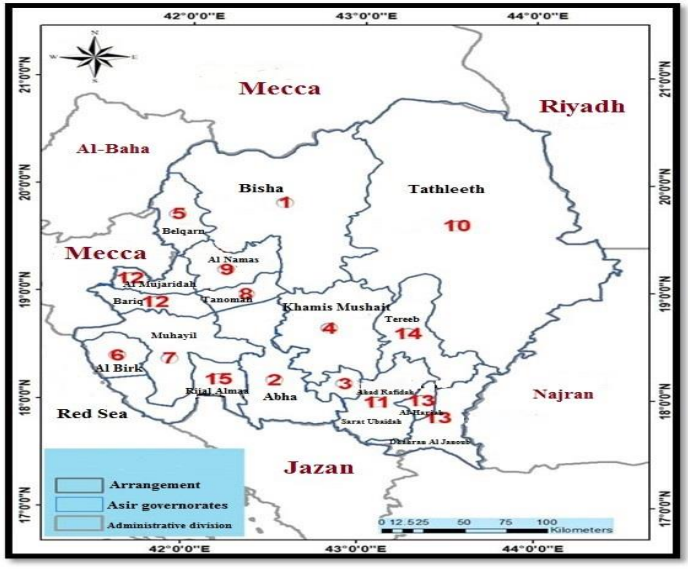
Table (5) Classification of plant production for the governorates of the Asir region

Governorate	Measuring production capacity	Arrangement
Abha	0.975	2
Khamis Mushait	0.958	4
Sarat Obeida	0.548	11
Bisha	0.981	1
Rijal Almaa	-.234	15
Mahayil Asir	0.897	7
Tareeb	-.0333	14
Tathleeth	0.566	10
Dhahran Al Janoub and Al-Harjah	-0.44	13
Al-Majaridah and Barq	0.225	12
Ahad Rufaidah	0.970	3
Tanmomah	0.776	8
Al Namas	0.721	9
Al Birk	0.933	6
Belqarn	0.955	5

Source: The table was created by researchers based on the SPSS program

Based on the above and in Table (5), we find that the productive power varies from one governorate to another in the Asir region for the year 2020 AD, where Bisha Governorate ranked first in productive power with 0.981, and Abha Governorate came in second place with 0.975, followed by Uhud Rufaidah Governorate with 0.970, and Khamis Mushait ranked fourth with 0.958, and Al-Qarn ranked fifth with 0.955, while Al-Barak Governorate ranked sixth with a total productive strength of 0.933, Mahayil Asir Governorate ranked seventh with 0.897, and Tanumah Governorate ranked eighth with 0.776 in productive strength. Al-Namas ranked ninth with .072 tons, while Tathleeth ranked tenth with a production strength of 0.566, and Sarat Ubaidah, Al-Majadara, Barq, Tarib, and Dhahran Al-Janoub governorates ranked eleventh, twelfth, thirteenth, and fourteenth with a production strength of .0548, 0.225, -.044, and - .333- respectively. Rijal Al Maa Governorate is ranked fifteenth, Fig.(4)

Fig. (4) Ranking of the governorates of the Asir region according to productive power.



Source: Researchers' work using GIS program.

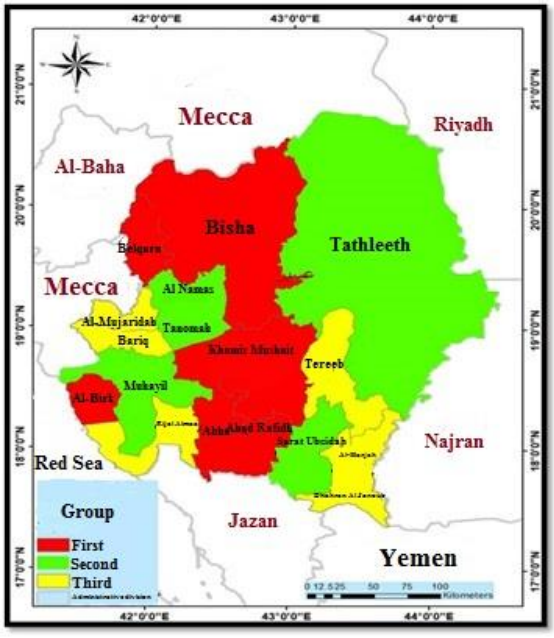
In order to divide the Asir region into categories, the Scripter method was used (Mendential, 1983, p. 64). The results were as in Table (6) and Fig. (5):

Table(6) Strength classes for the governorates of Asir region

Categories	Number of governorates	Group	Names of governorates
.975 - .933	6	First	Bisha - Abha - Ahad Rufaidah - Khamis Mushayt - Balqarn - Al-Birk
.897 - .548	4	Second	Mahayil Asir - Tanumah - Al-Namas - Tathleeth
.225 - -.234-	7	Third	Sarat Ubaida - Al-Majadara - Barq - Tarib - Dhahran Al-Janoub and Al-Harja - Rijal Al-Maa

Source: Table prepared by the researcher based on the results of the study.

Fig. (5) Classification of the Asir region according to productive capacity in 2020



Source: Figure created by the researcher using GIS Program.

Conclusions:

The study concluded the following results:

-Factorial analysis showed the presence of three main factors that together explained about 86.55% of the total variation in the development of plant production in the governorates of the Asir region.

-The result of the study was three mathematical algorithms that could measure the development of plant production in the Asir region according to the three main factors:

First factor equation:

$$\lambda 1=44.250\%=-0.521*X\_1\ 0.810*X\_2+0.78*X\_3+0.842*X\_4+0.755*X5$$

Second factor equation:

$$\lambda 2=24.960\%-0.228*X\_1+0.352*X\_2+0.936*X\_3-0.226*X\_4-0.380*X5$$

Third factor equation:

$$\lambda 3=17.344\%=0.796*X\_1+0.291*X\_2+0.104*X\_3+0.339*X\_4-0.153*X5$$

-The study classified the governorates of the Asir region based on the results of the analysis into groups according to negative and positive, and a statement of productive force according to the following table:

Table (7) Classification of governorates in the Asir region

Discrimination categories	Group	Governorates
.975 - .933	First	Bisha - Abha - Ahad Rufaidah - Khamis Mushayt - Balqarn - Al-Birk
.897 - .548	Second	Mahayil Asir - Tanumah - Al-Namas - Tathleeth
.225 - -.234	Third	Sarat Ubaida - Al-Majadara - Barq - Tarib - Dhahran Al-Janoub and Al-Harja - Rijal Al-Maa

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