DISTRIBUTION STRATEGIEY OF SOME CROPS IN EGYPT GOVERNORATES BY USING WATER FOOTPRINT ANALYSIS

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ABSTRACT

Egypt suffers from non-efficient irrigation water use and bad allocation of cropping areas among its governorates, in addition to its shortage water problems. Water footprint refers to the volume of water used to produce the crop, measured over the full planting time. Crops cultivated regardless of its water footprint which differ according to each governorate. Water footprint was conducted to enhance water use efficiency and recover water scarcity problems in Egypt. So in this study, total water footprint over the period from 2008 to 2012 was quantified for each governorate in Egypt for Rice, Maize and wheat crops from hydrological perspective. From results, it is recommended to plant Rice in Dakahlia, Kafr El-Sheikh and Damietta due to the lowest water footprint (1101.8, 1214.9 and 1280.3 m^3/ton, respectively) and highest Rice yield. However, it is more profitable to plant Maize in Dakahlia and Noubaria as they have the lowest values of water footprint (1227.4 and 1399.5 m^3/ton, respectively) and highest yield. With respect to Wheat crop, it was found that, the best governorates to be planted were Behera, Dakahlia, Damietta and Kafer El-shiekh where the values of water footprint were 1323.1, 1323.3, 1378.1 and 1387.1 m^3/ton, respectively as the yield was high in the previous governorates.

Key words: *water footprint, green water footprint, blue water footprint, total water footprint, Rice, Maize, Wheat, Egypt.*

INTRODUCTION

Water is one of the most important natural resources on our planet and a fundamental element of life whose preciousness requires diligent management. The recent increase in the use of freshwater as a result of human activities has lead to serious water scarcity in many regions **(Gerbens-Leenes and Hoekstra, 2008).**

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A recent McKinsey report1 predicts that by 2030, global water requirements will have grown from 4,500 billion m^3 today to 6,900 billion m^3. These worrying trends make managing and conserving water resources so vitally important **(Felix, 2012)**. Irrigation water management is managing soil moisture so that an optimum quantity of irrigation water is applied at appropriate times. Good water management can both increase crop production and reduce costs

(USDA and MSU, 1990). By linking a large range of sectors and issues, virtual water and water footprint analyses provide an appropriate framework to find potential solutions and contribute to a better management of water resources **(Aldaya and Llamas, 2008)**. More over it is a must to manipulate water use strategy. The water footprint is a multidimensional indicator, showing water consumption volumes by source and polluted volumes by type of pollution; all components of a total water footprint are specified geographically and temporally **(Hoekstra *et al.*, 2011)**. Detailed national water footprint studies have been conducted for European countries, **(Van Oel *et al.*, 2009)** and countries outside Europe, **(Bulsink *et al.*, 2010)**; **(Liu and Savenije, 2008)**; and **(Verma *et al.*, 2009)**. To reduce the pressure putting on fresh water resources, assessment of blue, green, and grey water footprint would be conducted. A spatially and temporally explicit water footprint analysis is also required by the variability of water resources in space and time **(Mekonnen, 2011)**. So the objectives of this study was to estimate the total water footprint for Rice, Maize and Wheat in Egypt governorates over the period 2008 to 2012. It helps decision maker promoting the most suitable governorate to plant each crop and adjust crops planted areas to decrease irrigation water consumption and save water

METHODOLOGY

The present study estimates the total water footprint of Rice, Maize and Wheat in Egypt governorates through the period from 2008-2012 and considers the green, blue and grey water components for these crops. This was done according to the crop data available for each governorate.

The water footprint calculated using the methodology developed by **Hoekstra and Hung (2002; 2005)** and **Chapagain and Hoekstra (2003; 2004)**. The virtual water content of a product is the volume of freshwater and its natural concentration in the receiving water body. The last value is divided by the crop yield (Y) to calculate the grey water footprint. So total water footprint (WF_{Tot}) calculated as follows:

$$WF_{Tot}(m^3/ton) = \frac{CWR_{green}}{Y} + \frac{CWR_{blue}}{Y} + [\frac{\propto * Appl}{c_{max} - c_{nat}}]/Y \ldots\ldots\ldots\ldots\ldots (3)$$

Appl is the application rate of chemicals to the field per hectare in (kg/ha). c_{max} is the maximum acceptable concentration in (kg/m^3). c_{nat} is the natural concentration for Nitrogen in (kg/m^3). α is the leaching-run-off fraction; and Y is the yield in (ton/ha).

RESULTS AND DISCUSSION

The water footprint flow analyses for Rice, Maize and Wheat crops are evaluated over the period (2008-2012) for each governorate to achieve the aims of this study.

Rice crop

1- Governorates cropping area

According to agriculture directorates statistics, Table 1 illustrates the average planted area for Rice over the period (2008-2012) for Egypt governorates. It is clear that, the cultivated areas in Dakahlia and Kafer_El-sheikh were the highest among other governorates. However the lowest cultivated Rice areas were in Suez, Cairo and Assuit.

2- Crop water requirements

CWR includes two components: effective rainfall (green water) and irrigation water (blue water). CWR refers to the water needed for evapotranspiration under ideal growth conditions, measured from planting to harvest. As shown in Figure 1, over the period from 2008 to 2012, New Valley had the largest average of CWR (15840.2 m³/ha). On the other hand, Ismailia and Port Said had the lowest CWR (8608.8, 8608.4 m3/ha respectively). This result is due to climatic condition.

Table 1: The total planted area (ha) for Rice in (2008-2012) for Egypt governorates

Governorates	Area (ha)					
	2008	2009	2010	2011	2012	Average
Alexandria	1885	857	71	1068	859	948
Behera	97830	84098	65028	88570	83951	83895.4
Gharbia	74972	53261	44054	51787	61756	57166
kafer_El-sheikh	150484	136341	116102	124535	121851	129862.6
Dakahlia	205567	151071	120688	177077	190969	169074.4
Damietta	31077	27184	23709	29060	28107	27827.4
Sharkia	142120	107659	78496	99308	110382	107593
Ismailia	1983	1661	1357	2287	2582	1974
port said	8995	8475	6533	9412	8394	8361.8
Suez	0	18	0	0	0	3.6
Menoufia	0	0	0	0	549	109.8
Qalyoubia	11391	4175	2218	6958	6484	6245.2
Cairo	14	4	3	0	1	4.4
Beni suef	627	198	42	120	288	255
Fayoum	12706	0	0	0	313	2603.8
Assuit	81.5	5	0	0	0	17.3
New valley	2829	6	825	1543	1682	1377
Noubaria	732	55	53	109	117	213.2

3- Green, blue, and grey water footprint for Rice

Mostly there is a rare rain in Egypt. Therefore, WF_{blue} for Rice is higher than the WF_{green} and WF_{grey} (Figure 2). The WF_{blue} for Rice is 1281 m^3/ton through the period 2008-2012. On the other hand, the WF_{grey} for Rice is approximately 7.11 m^3/ton over the period 2008-2012. In addition the WF_{grey} for Rice is 309 m^3/ton, due to the addition of Nitrogen during the growing season.

Over the period 2008-2012, as shown in Figure 2 Dakahlia has the lowest WF_{blue} for Rice (848.7 m^3/ton in average) and it has the lowest WF_{grey} (242.3 m^3/ton in average) due to the highest Rice yield . On the other hand, the highest WF_{blue} for Rice in 2008 to 2012 in New Valley was 1977.2 m^3/ton in average and its average WF_{grey} was 314.5 m^3/ha. In 2008 Noubaria had the highest WF_{blue} for Rice. These results could be due to the differences in soil type and climate conditions although the lowest Rice yield in Noubaria causes the highest WF_{grey} Because the green water footprint was dependant on rain in each governorate.

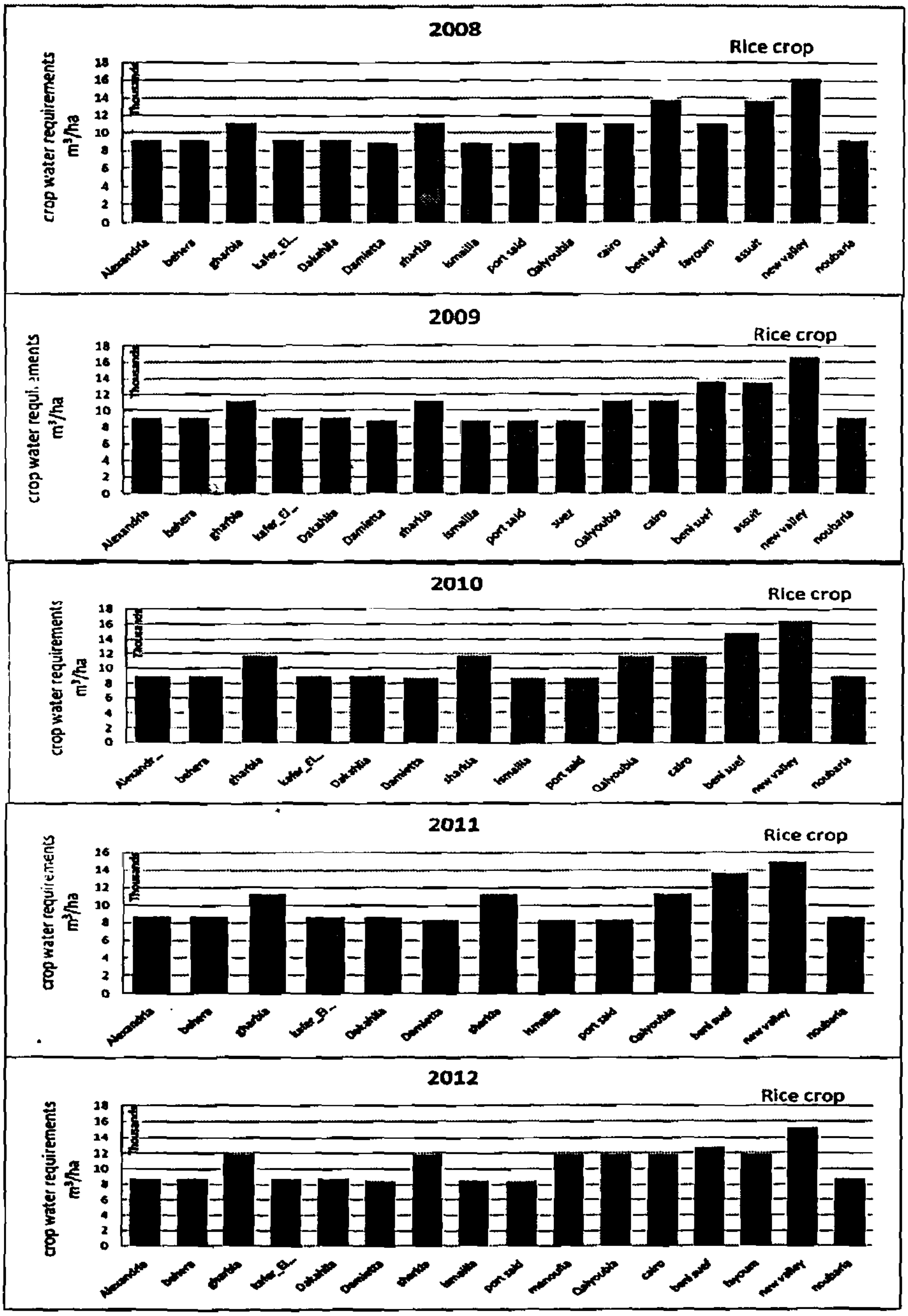

Figure 1: Crop water requirements for Rice in Egypt governorates from 2008 to 2012.

4- Total water footprint for Rice

The water footprint analysis established the amount of water required by specific crops and it differs according to crop type, yield and climate. Water footprint also depends on the amount of nitrogen applied to the soil during growing season. Although increasing the amount of nitrogen applied to the soil causes increasing in total water footprint, decreasing the amount of nitrogen applied to the soil may cause decreasing in Rice yield. So the amount of nitrogen applied to the soil should be controlled to benefit crop and not waste water. Figure 3 illustrate the results for the period from 2008 to 2012 and by estimating the averages of this period, the results were as follows; Noubaria had the largest WF_{Tot} (2200 m^3/ton) and New Vally had 2292.5 m^3/ton. This result is due to hot climate and lower Rice yield in this governorates. On the other hand, Dakahlia had the lowest WF_{Tot} (1101.8 m^3/ton). Followed by Kafr El-Sheikh and Damietta had low values (1214.9 and 1280.3 m^3/ton respectively) .These results are due to the huge planted areas of Rice and their high yield.

Maize crop

1- Cropping area

Table 2 shows the total planted area for Maize over period 2008 to 2012. From the five years average, it is clear that Sharkia and Menia had the largest Maize planted areas however, Sharkia had the largest planted area in 2010. Cairo and North Sinai had the lowest planted area through the study period.

2- Crop water requirements for Maize

From the results show in Figure 4, New Valley and Aswan had the largest CWR for Maize which are 11707.8 and 11860.4 m^3/ha while, North Sinai had the lowest values (606.6 m^3/ha). Differences among governorates climatic conditions explain these results.

3- The green, blue, and grey water footprint for Maize

The WF_{blue} for Maize was 1420.5 m^3/ton during the period 2008 to 2012, While the WF_{green} for Maize was 22.9 m^3/ton. This is due to planting Maize in summer season where there is littleness rain in Egypt. In addition, the WF_{grey} for Maize was 900.37 m^3/ton due to applying a huge Nitrogen during growing season. As illustrated in Figure 5, Dakahlia had the lowest WF_{blue} (678.6, 671.9, 666.24, 685.8 and 626.5 m^3/ton through 2008 to 2012, respectively).

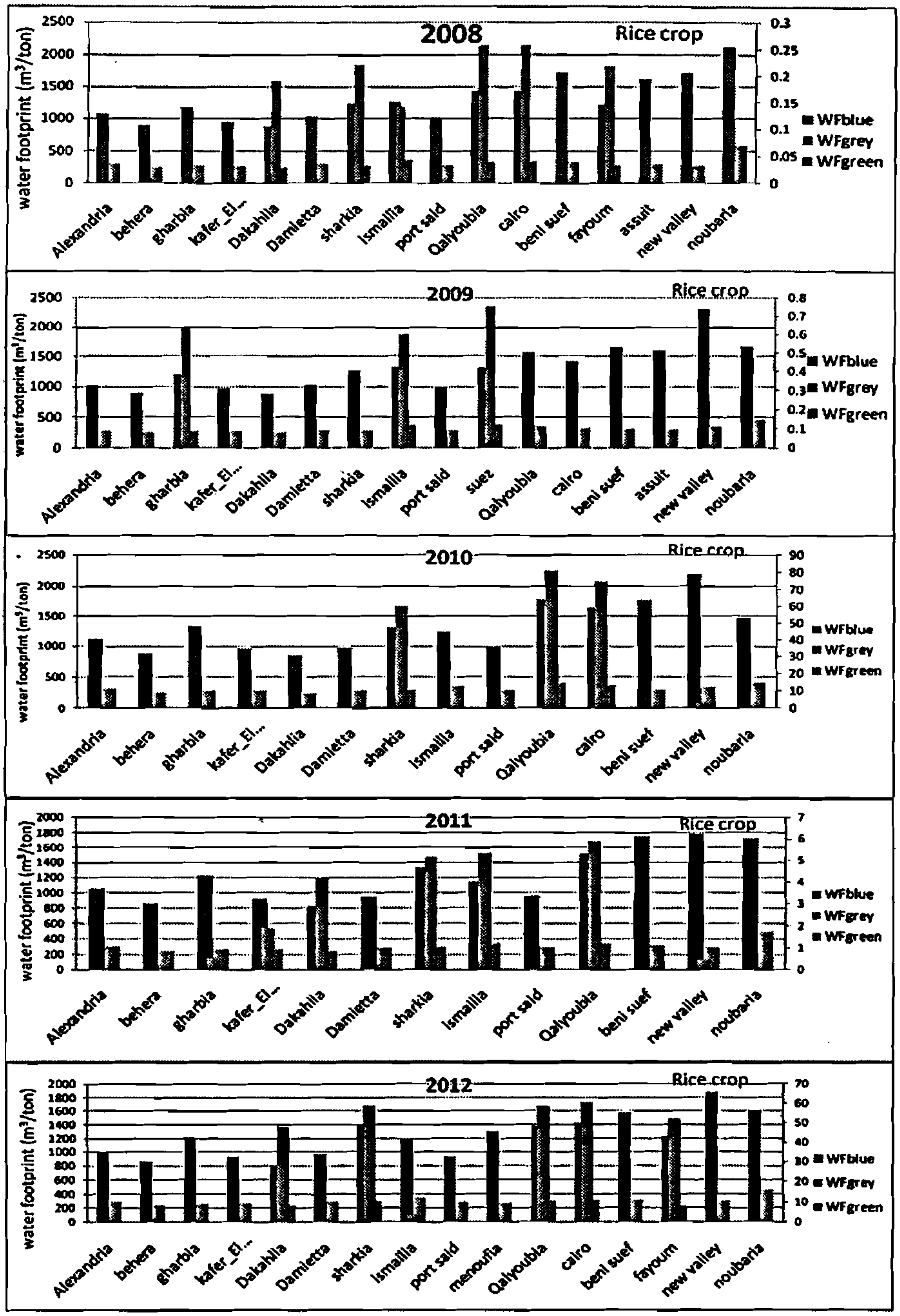

Figure 2: Green, blue and grey water footprint for Rice in Egypt governorates from 2008 to 2012.

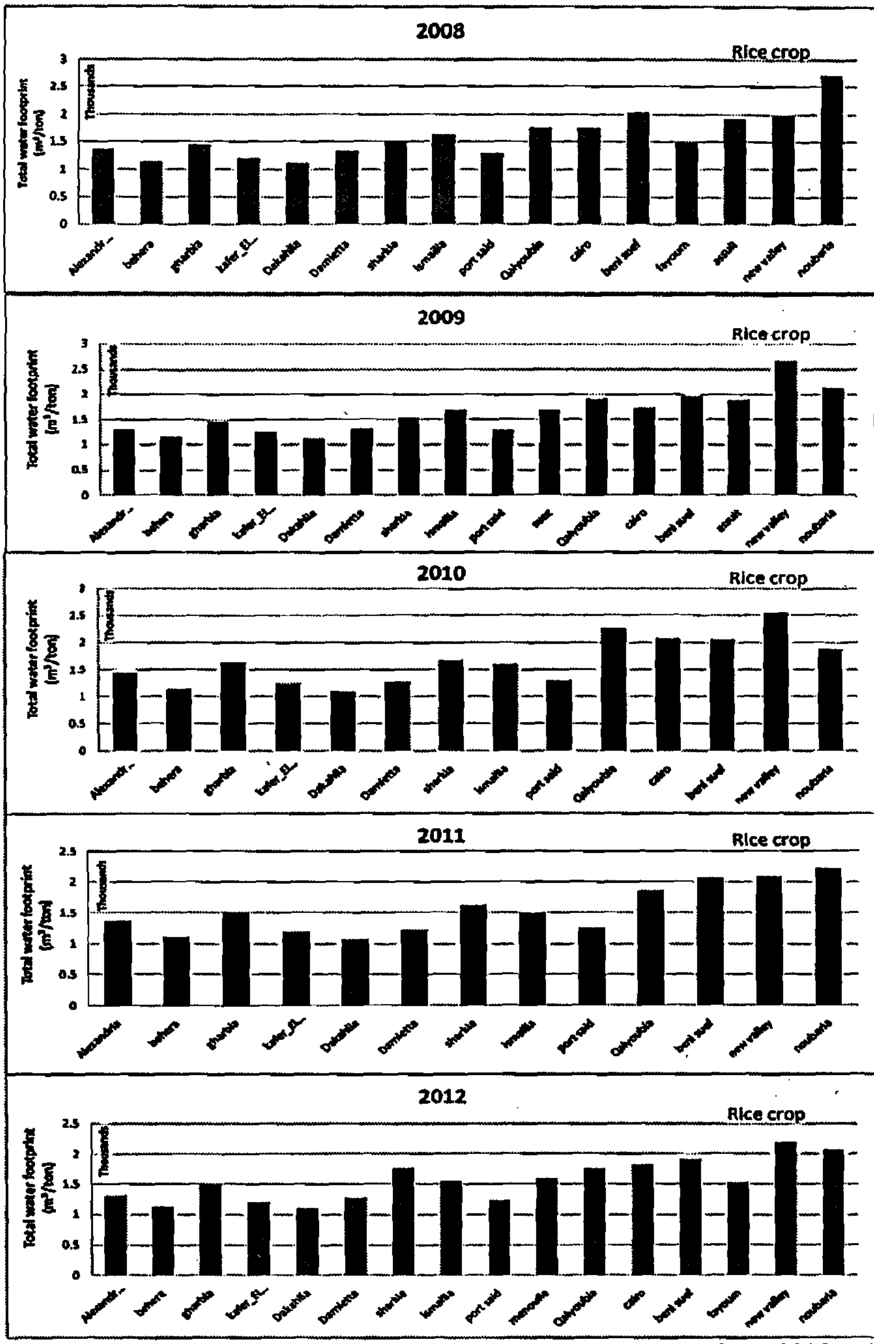

Figure 3: Total water footprint for Rice in Egypt governorates from 2008 to 2012.

Table 2: The planted Maize area (ha) for Egypt governorates from 2008 to 2012

Governorates	Area (ha)					
	2008	2009	2010	2011	2012	Average
Alexandria	14453	14175	12841	13349	14957	13955
Behera	76021	88370	73164	63986	94145	79137.2
Gharbia	28422	26592	20501	18903	26940	24271.6
kafer_El sheikh	22693	22546	25662	23192	33560	25530.6
Dakahlia	24233	37657	52705	22906	24305	32361.2
Damietta	897	1548	3648	741	764	1519.6
Sharkia	84878	98522	131513	101177	106029	104423.8
Ismailia	16055	15674	14168	13583	15246	14945.2
Port said	1019	5953	3749	3040	4736	3699.4
Suez	1351	1497	1358	1090	1182	1295.6
Menoufia	68620	38521	67295	81705	89876	69203.4
Qalyoubia	31705	40184	37069	24997	30720	32935
Cairo	55	11	8	96	50	44
Giza	11725	693	462	20746	26990	12123.2
Beni Suef	71839	63506	58021	56472	75044	64976.4
Fayoum	27323	46040	32564	26105	41323	34671
Menia	126653	128236	108867	105189	123006	118390.2
Assuit	55162	57675	57145	51412	66890	57656.8
Suhag	54727	55723	57411	53812	58856	56105.8
Qena	22994	21488	16685	16166	21708	19808.2
Luxor	6018	5619	7005	6800	8188	6726
Aswan	5793	5267	3856	4072	3898	4577.2
New Valley	667	2412	152	83	3085	1279.8
Matruh	2373	4553	1302	1257	546	2006.2
North Sinai	161	131	67	51	73	96.6
Noubaria	25501	26168	24517	27653	33836	27535

The average values through the study period for Dakahlia, Noubaria and Damietta were 665.8, 770.2 and 774.2 m^3/ton respectively. On the contrary, the highest WF_{blue} for Maize for the study period was in North Sinai, New Valley and Aswan (376, 2355.4 and 2173.2 m^3/ton, respectively).

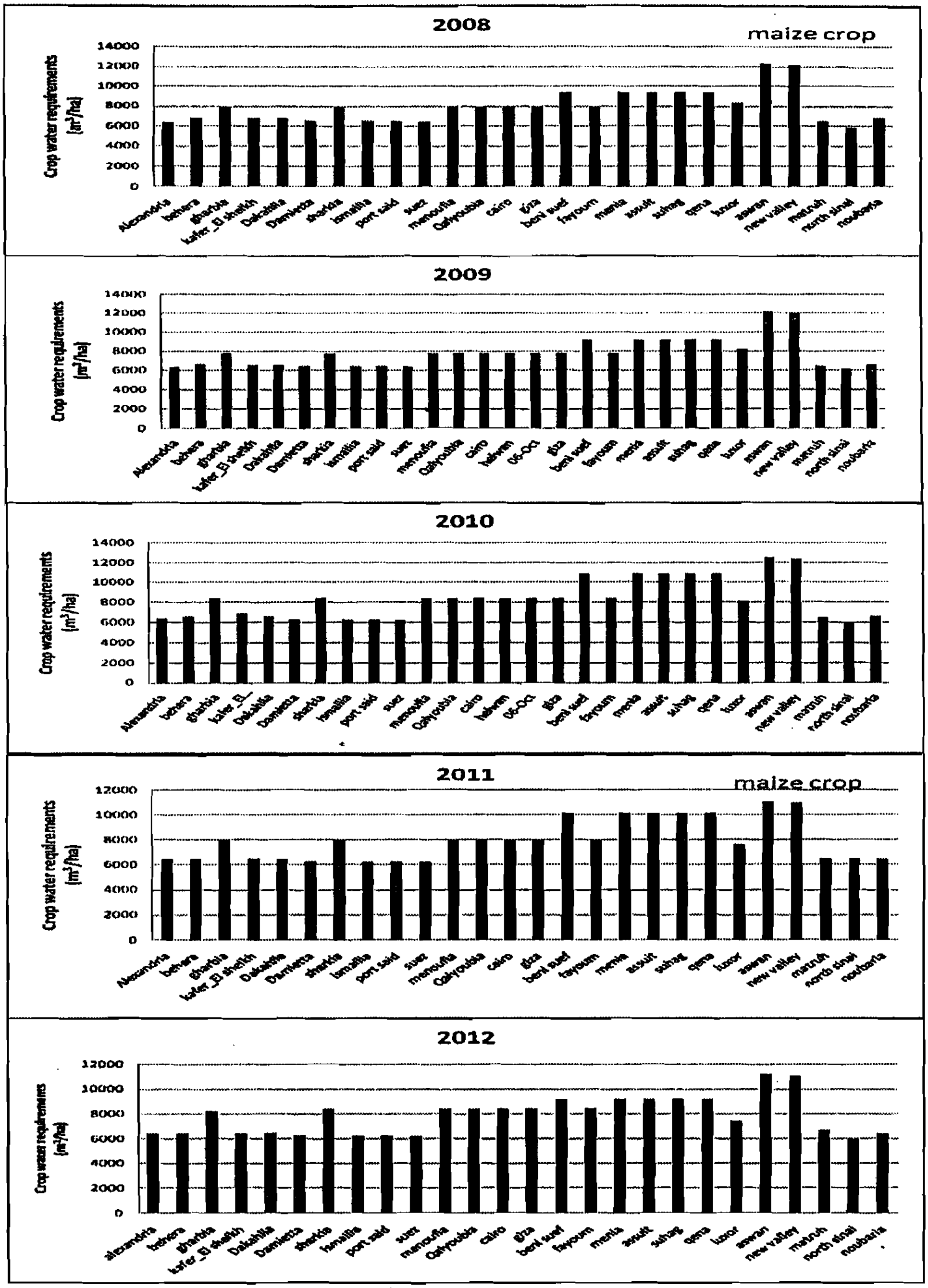

Figure 4: Crop water requirement for Maize in Egypt governorates from 2008 to 2012

The previous results caused by the differences in soil type and climate conditions. While, the highest WF_{grey} was in North Sinai because it had the lowest Maize yield over this year. On the other hand, Dakahlia and Behera had the lowest WF_{grey} (533 and 569.5 m^3/ton).

4- Total water footprint for Maize

The water footprint analysis established the amount of water required by specific crops and it differs according to crop type, yield and climate. It dependant on the amount of nitrogen that applied to the soil. That is because WF_{Tot} had positive relationship with WF_{grey} while WF_{grey} has positive relationship with the amount of nitrogen that applied to the soil. As illustrated in Figure 6, North Sinai had the largest WF_{Tot} (6970.5 m^3/ton, in average). Also, in New valley, Aswan and Qena governorates average WF_{Tot} over the study period were 3378.9, 3133.92 and 2966 m^3/ton, respectively. This result is due to lower Maize yield in this governorates. On the other hand, high Maize yield in Dakahlia and Noubaria decreases WF_{Tot} to 1227.4 and 1399.5 m^3/ton, respectively.

Wheat crop

1- Cropping area

Fayoum, Sharkia, Dakahlia, Behera governorates had the largest Wheat planted areas over years from 2008 to 2012 (Table 3). This is a general trend in Egypt, where Egypt government takes great efforts to increase wheat planted area to achieve self-sufficiency and stop import of Wheat.

2- Crop water requirements for Wheat

Figure 7 shows the CWR of Wheat for each governorate in Egypt over the period from 2008 to 2012. As illustrated from the average, CWR during the study period, South Sinai, Aswan, and New Valley had the largest CWR (10347.6, 10244.8 and 10149.2 m^3/ha, respectively). On the other hand, due to climatic conditions, Ismailia, Port Said, Suez and Matruh had the lowest CWR (5350.8, 5350.2, 5332.6 and 5578.4 m^3/ha, respectively).

3- Green, blue, and grey water footprint for Wheat

Figure 8 shows that, the average lowest WF_{blue} over the period from 2008 to 2012 for Wheat was in Damietta, Behera, Kafer El-shiekh and Suez (811.8, 832.2, 837.2 and 845.2 m^3/ton, respectively). In 2009, Kafer El-shiekh had the lowest WF_{blue} for Wheat (799.6 m^3/ton).

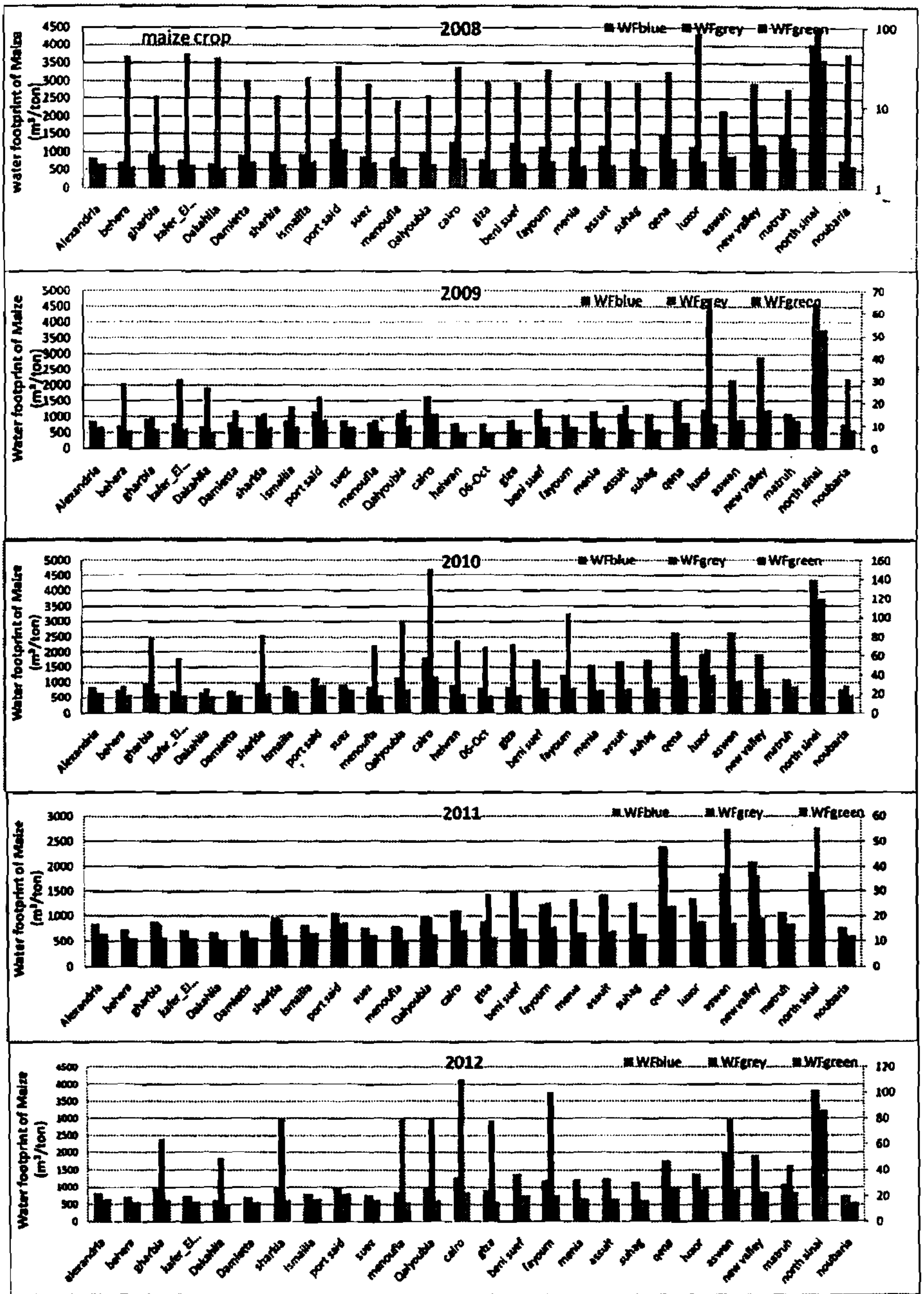

Figure 5: Green, blue and grey water footprint for Maize in Egypt governorates from 2008 to 2012.

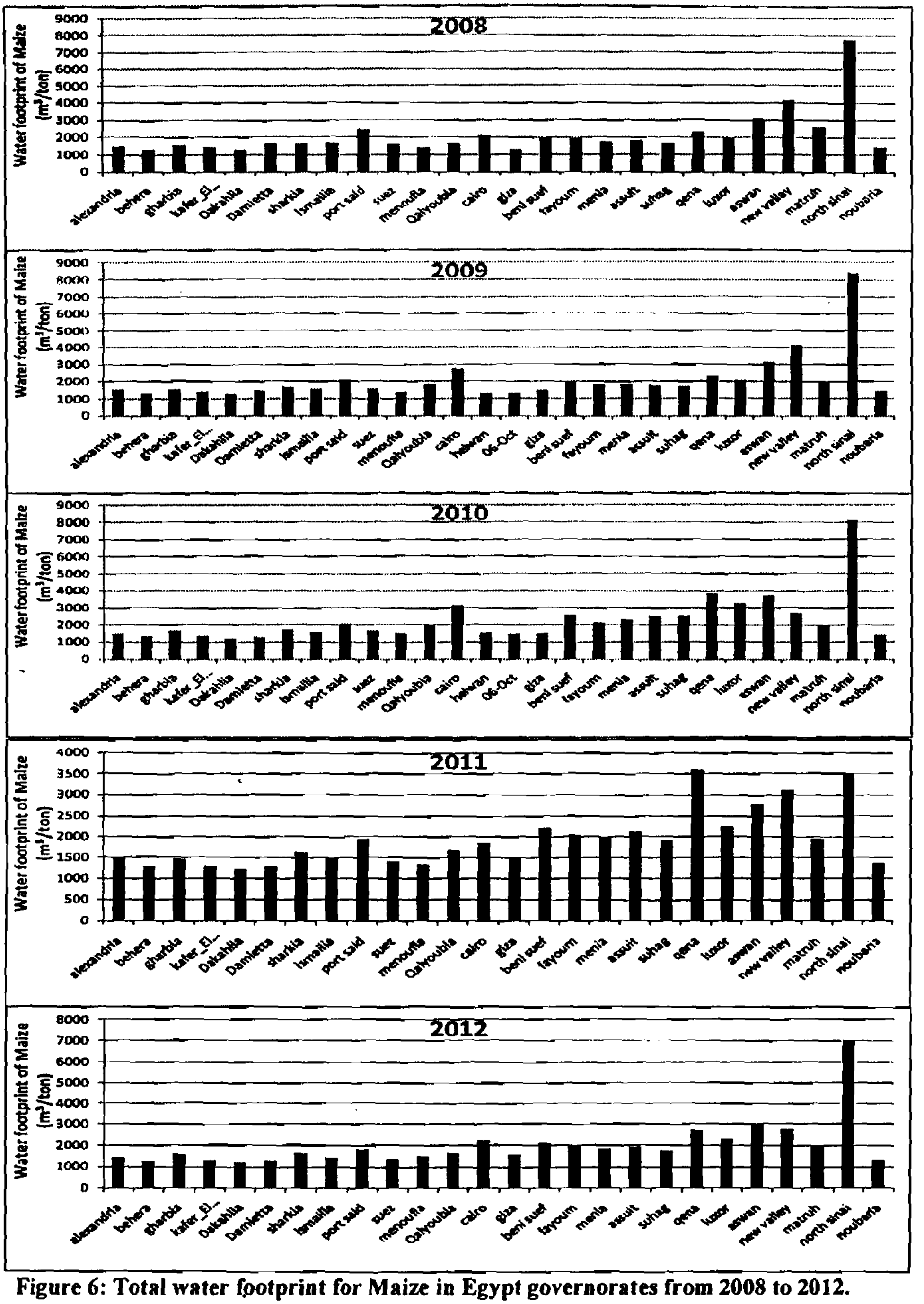

Figure 6: Total water footprint for Maize in Egypt governorates from 2008 to 2012.

On the other hand, South Sinai had the highest WF_{blue} for Wheat from year 2008 to 2012. These results caused by the differences in soil type and climate conditions in these governorates. As well as, the highest WF_{grey} was in South Sinai (934.9 m^3/ton) because it had the lowest Wheat yield. In 2008, 2009, 2011, and 2012. Menoufia had the lowest WF_{grey} due to the highest Wheat yield. While, the (WF_{green} was depended on rain in each governorate.

Table 3: The planted Maize area (ha) for Egypt governorates from 2008 to 2012

Governorates	Area (ha)					
	2008	2009	2010	2011	2012	Average
Alexandria	27186	28349	25378	26440	32884	28047.4
Behera	115142	139476	123168	133372	135037	129239
Gharbia	65685	68892	62110	61538	63432	64331.4
kafer_El-sheikh	98151	109961	98621	100630	99236	101319.8
Dakahlia	121927	129010	124482	126008	127380	125761.4
Damietta	12598	11184	11588	13434	12433	12247.4
Sharkia	146580	175731	167964	169669	178513	167691.4
Ismailia	17360	19641	22738	21008	22595	20668.4
Port said	6575	8213	7955	8410	7016	7633.8
Suez	1657	1829	2051	1871	1959	1873.4
Menoufia	45939	51876	45171	46560	53168	48542.8
Qalyoubia	21921	21135	20624	20839	22293	21362.4
Cairo	85	41	11	11	34	36.4
Giza	15929	187	168	90	17026	6680
beni Suef	57139	58583	53642	54859	52971	55438.8
Fayoum	63694	66837	70677	687362	73426	192399.2
Menia	88184	97024	89194	89786	91834	91204.4
Assuit	71777	70976	69016	69869	80176	72362.8
Suhag	72518	74807	75846	78120	73516	74961.4
Qena	49981	58562	40587	39588	44570	46657.6
Luxor	7144	6962	14662	15535	16951	12250.8
Aswan	11848	16349	19501	18906	21946	17710
New Valley	20760	24036	27508	35418	43397	30223.8
Matruh	22167	12684	10321	3654	1886	10142.4
North Sinai	883	0	0	0	105	494
South Sinai	13	10	54	23	89	37.8
Noubaria	63693	54266	56957	58967	53579	57492.4

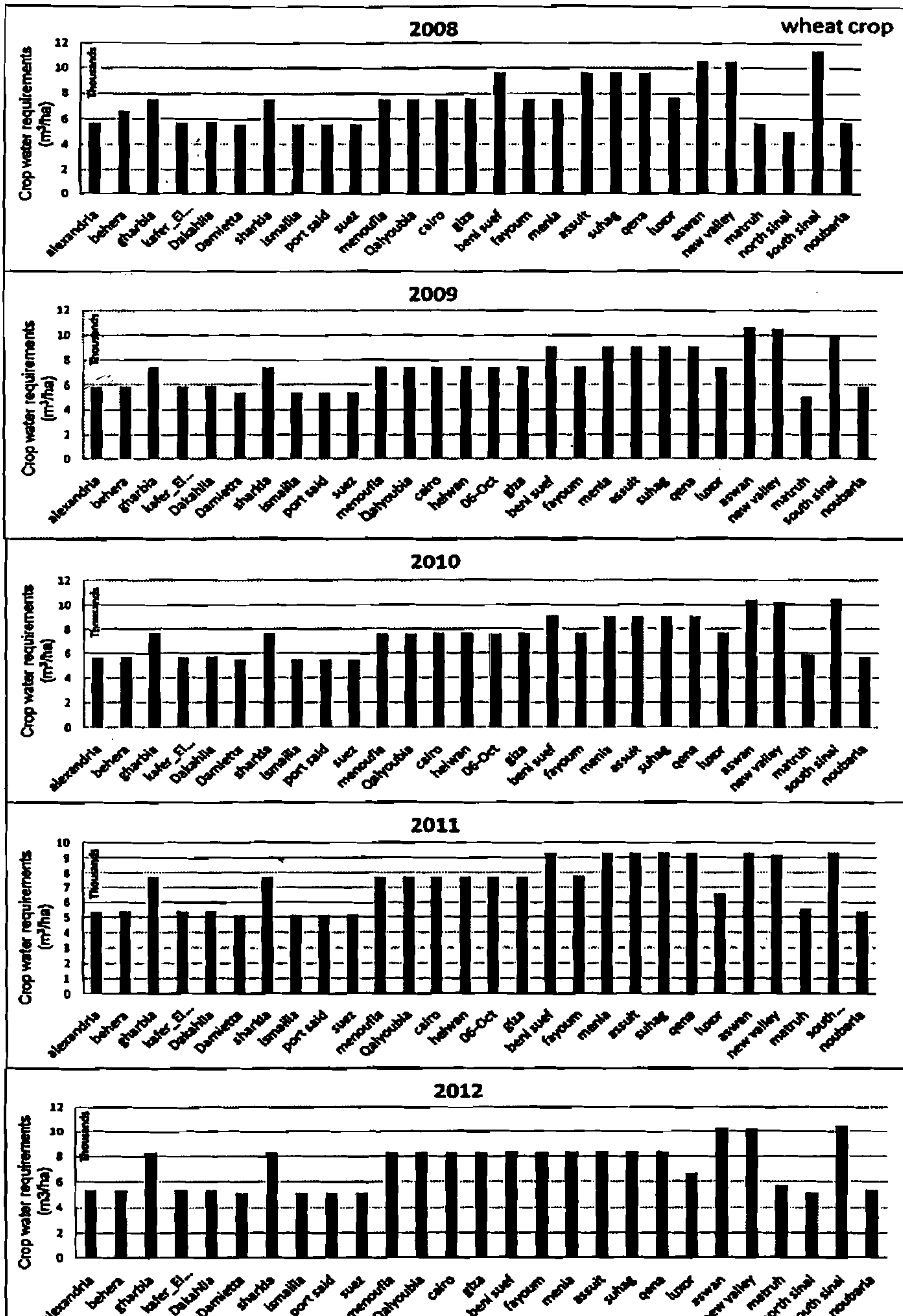

Figure 7: Crop water requirements for Wheat in Egypt governorates from 2008 to 2012

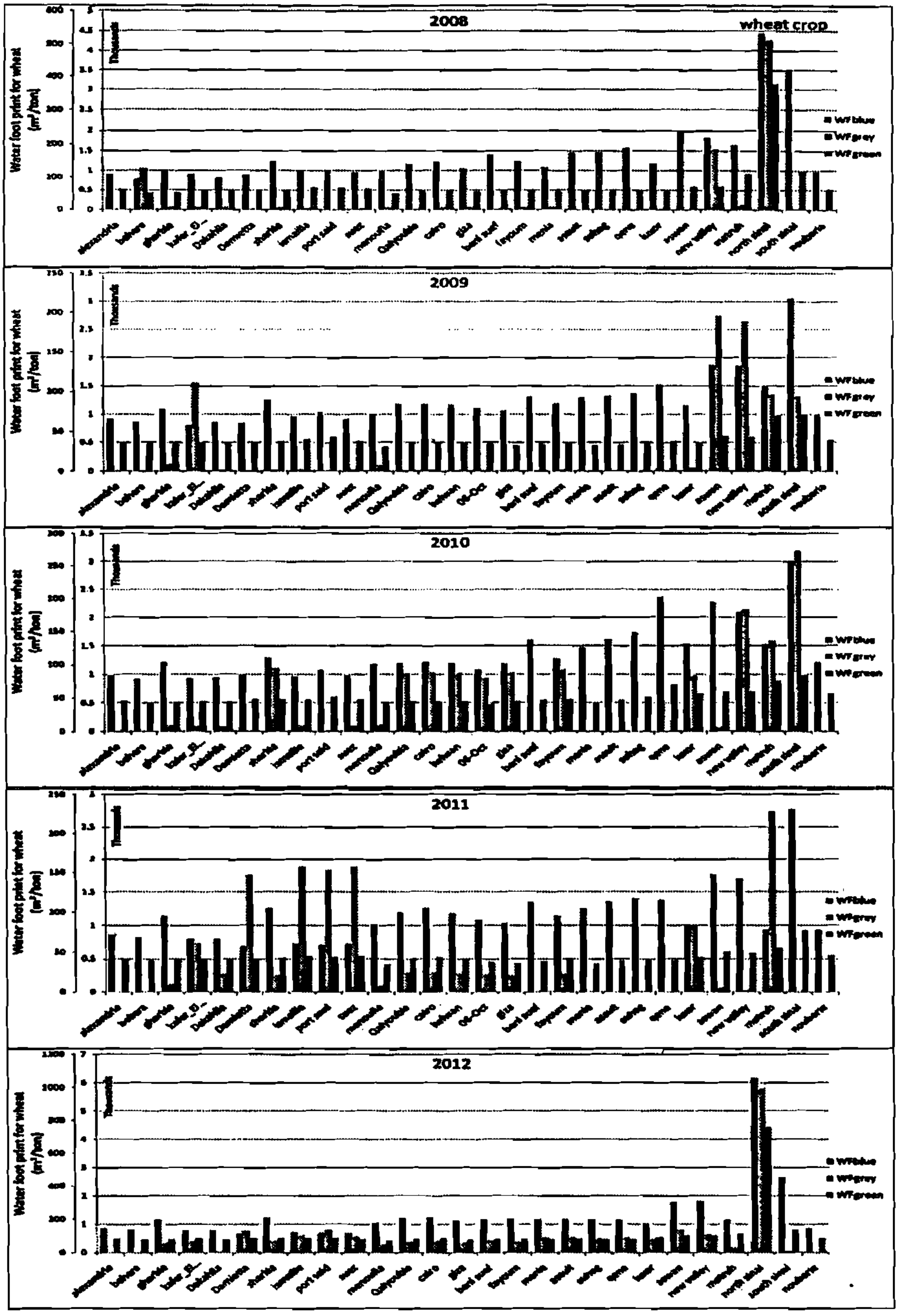

Figure 8: The green, blue and grey water footprint of Wheat in Egypt governorates from 2008 to 2012.

4- Total water footprint for Wheat

For each governorate, the average of the studied years was estimated for WF_{Tot} . Figure 9 shows The total water footprint for Wheat in governorates over the period from 2008 through 2012. South Sinai governorate had the lowest Wheat yield therefore, the highest WF_{Tot} was in it. Followed by New Valley, Aswan and Matruh (2604.1, 2620.4 and 2261 m^3/ton, respectively). On the other hand, Behera, Dakahlia, Damietta and Kafer El-shiekh governorates had the lowest WF_{Tot} (1323.1, 1323.3, 1378.1 and 1387.1 m^3/ton, respectively) in consequence of high Wheat yield.

CONCLUSIONS

Irrigation water requirements and Water footprint for Rice, Maize and Wheat in Egypt governorates over the period from year 2008 to 2012 was estimated in this study. The results for each crop were as follows:

Rice Crop:

New Valley had the largest average of CWR (15840.2 m^3/ha). On the contrary, the lowest CWR were in Ismailia and Port Said (8608.8, 8608.4 m^3/ha, respectively). As a reason of differences among governorates climatic conditions. Dakahlia had the lowest WF_{blue} for Rice (848.7 m^3/ton). Also it had the lowest WF_{grey} (242.3 m^3/ton) due to the highest Rice yield. On the other hand, the highest WF_{blue} for Rice in 2008 to 2012 was in New Valley (1977.2 m^3/ton) and its average WF_{grey} is 314.5 m^3/ha. The WF_{green} has less effect than the others due to the rare rainfall in Egypt in general.

Water footprint differs according to crop and soil type, yield and climate. Water footprint also depends on the amount of nitrogen applied to the soil during growing season. New Vally and Noubaria had the largest WF_{Tot} (2292 and 2200 m^3/ton). As a reason of the hot climate and lower Rice yield in governorates. On the other hand, Dakahlia had the lowest WF_{Tot} (1101.8 m^3/ton). Followed by Kafr El-Sheikh and Damietta had low values (1214.9 and 1280.3 m^3/ton, respectively).

Maize Crop

New Valley and Aswan had the largest CWR for Maize (11707.8 and 11860.4 m^3/ha, respectively) while, North Sinai had the lowest values (606.6 m^3/ha). As a reason of differences among governorates climatic conditions.

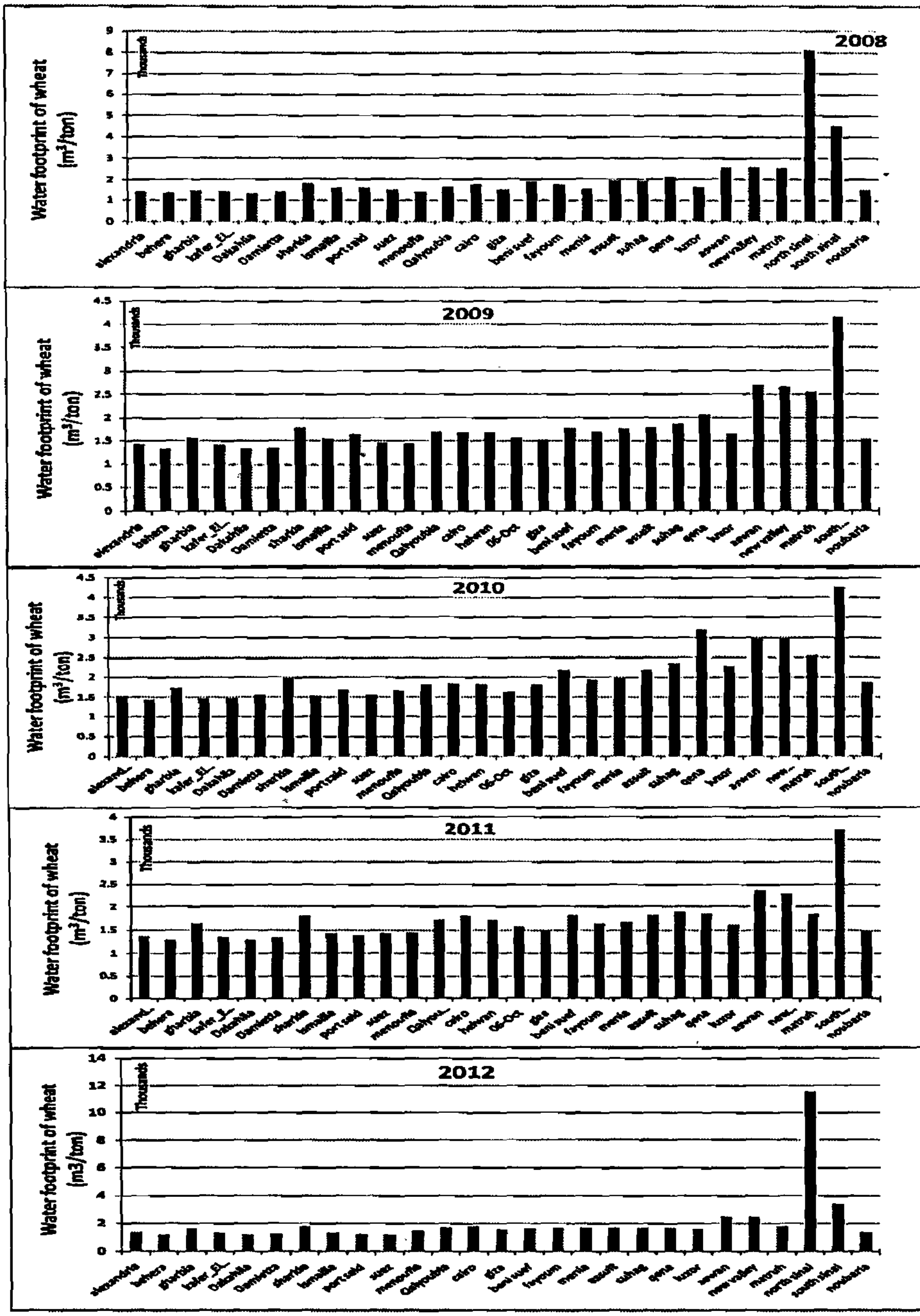

Figure 9: The total water footprint for Wheat in Egypt governorates from 2008 to 2012

The average WF_{blue} through the study period for Dakahlia, Noubaria and Damietta were 665.8, 770.2 and 774.2 m^3/ton, respectively. On the contrary, the highest WF_{blue} for Maize for the study period was in North Sinai, New Valley and Aswan (376, 2355.4 and 2173.2 m^3/ton, respectively). The previous results caused by the differences in soil type and climate conditions. While, the highest WF_{grey} was in North Sinai because it had the lowest Maize yield. On the other hand, Dakahlia and Behera had the lowest WF_{grey} (533 and 569.5 m m^3/ton).

North Sinai had the largest WF_{Tot} (6970.5 m^3/ton in average). Also in New valley, Aswan and Qena governorates average total water footprint over the study period were 3378.9, 3133.92 and 2966 m^3/ton, respectively. This result was due to lower Maize yield in this governorates. On the other hand, high Maize yield in Dakahlia and Noubaria decreases WF_{Tot} to 1227.4 and 1399.5 m^3/ton, respectively.

Wheat Crop

During the study period, South Sinai, Aswan, and New Valley had the largest CWR (10347.6, 10244.8 and 10149.2 m^3/ha, respectively). On the other hand, due to climatic conditions, Ismailia, Port Said, Suez and Matruh had the lowest crop water requirements (5350.8, 5350.2, 5332.6 and 5578.4 m^3/ha, respectively).

The average lowest WF_{blue} over the period from 2008 to 2012 for Wheat was in Damietta, Behera, Kafer El-shiekh and Suez (811.8, 832.2, 837.2 and 845.2 m^3/ton, respectively). As well as, the highest WF_{grey} was in South Sinai (934.9 m^3/ton) because it had the lowest Wheat yield.

South Sinai governorate had the lowest Wheat yield therefore, the highest WF_{Tot} was in it. Followed by New Valley, Aswan and Matruh (2604.1, 2620.4 and 2261 m^3/ton, respectively). On the contrary, Behera, Dakahlia, Damietta and Kafer El-shiekh governorates had the lowest WF_{Tot} (1323.1, 1323.3, 1378.1 and 1387.1 m^3/ton, respectively). As a reason of high yield.

Finally; according the previous results of CWR and WF_{Tot} for different governorates in Egypt, the suggested strategy for growing crops in Egypt could explained as follows:

- Increase the Rice cultivation area in Dakahlia, Kafr El-Sheikh and Damietta. Also, make efforts to decrease it in other governorates such as Noubaria and New Vally
- Increase Maize cultivation area in Dakahlia and Noubaria. On the other hand, decrease the planting Maize area in some governorates such as North Sinai, New valley, Aswan and Qena.
- Increase Wheat cultivation areas in Behera, Dakahlia, Damietta and Kafer El-sheikh and decrease it in South Sinai, New Valley, Aswan and Matruh governorates.

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الملخص العربي

استراتيجية توزيع بعض المحاصيل في محافظات مصر باستخدام البصمة المائية

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تعانى مصر عجز كبير فى المياه نتيجة للزيادة السكانية المضطردة ومحدودية مياة الري بالإضافة لسوء توزيع المحاصيل بين محافظات مصر المختلفة دون الأخذ في الاعتبار الظروف الجوية ونوع النبات والتربة الملائم وتأثير ذلك علي الانتاجية. لذا يجب العمل علي تحسين كفاءة استخدام المياه وذلك عن طريق الإدارة المتكاملة للمياة داخل مصر خصوصا فى القطاع الزراعى.

وتعتبر البصمة المائية أداه من أدوات الإدارة المتكاملة للمياه ومفهوم البصمة المائية يحدد المياه المستخدمة أثناء الإنتاج معبرا عنها بوحدات المتر المكعب لكل وحدة كتلة من المنتج. وتتكون البصمة المائية من ثلاث مكونات البصمة المائية الخضراء والتى يستفيد منها النبات عن طريق المطر والبصمة المائية الزرقاء والتى يستفيد منها النبات عن طريق مجارى المياه (الأنهار والمسطحات المائية) والبصمة المائية الرمادية وهى التى تتلوث أثناء إنتاج النبات نتيجة للتسميد النيتروجينى طوال فترة نمو النبات.

فى هذه الدراسة تم تقدير الاحتياجات المائية والبصمة المائية الكلية لمحاصيل الأرز والذرة والقمح لكل محافظه تمت زراعة هذه المحاصيل بها خلال الفترة من عام ٢٠٠٨ إلي ٢٠١٢ وتم تحديد افضل المحافظات لزراعة كل محصول من المحاصيل تحت الدراسة لكي تسهل علي متخذي القرار عملية توزيع المحاصيل علي المحافظات المختلفة . وكانت النتائج كالأتى:

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بالنسبة لمحصول الأرز فإن أفضل محافظة لزراعته داخل مصر هى محافظات الدقهلية وكفر الشيخ ودمياط حيث ان هذه المحافظات تحتوى على أعلي انتاجية واقل بصمة مائية لمحصول الارز (١١٠١,٨ ، ١٢١٤,٩ و ١٢٨٠,٣ م٣/طن علي الترتيب خلال فترة الدراسة من ٢٠٠٨ إلي ٢٠١٢). ويفضل العمل علي تقليل مساحات الأرز في محافظات مثل النوبارية والوادي الجديد حيث انها تحتوي علي أعلي بصمة مائية. بينما يفضل زيادة مساحات الذرة بمحافظتى الدقهلية والنوبارية حيث تحتويان علي أعلي انتاجية وأقل بصمة مائية للذرة (١٢٢٧,٤ و ١٣٩٩,٥ م٣/طن علي الترتيب خلال فترة الدراسة) بينما يفضل تقليل مساحات الذرة في محافظات مثل شمال سيناء والوادي الجديد وأسوان وقنا . بينما محافظة البحيرة والدقهلية ودمياط وكفر الشيخ كانت تحتوى على اقل بصمة مائية لمحصول القمح (١٣٢٣,١ و ١٣٢٣,٣ و ١٣٨٧ و ١٣٨٧,١ م٣/طن علي الترتيب خلال الفترة من ٢٠٠٨ إلي ٢٠١٢). لذا يفضل زيادة مساحات القمح بهذه المحافظات وعلي العكس يفضل تقليل مساحات القمح في محافظات مثل شمال سيناء والوادي الجديد وأسوان ومطروح.