Water and Agricultural Assessment for Sustainable Development of Sinai, Egypt

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1. Introduction In an attempt to improve the productivity and sustainability of water use and increase water supply to bring 0.26 million ha additional land under cultivation, Egypt has initiated the North Sinai Development Project (NSDP). Irrigation canal of NSDP has designed with the objective to discharge 4.45 billion m^3 of water, which is blend of agricultural drainage water with freshwater from River Nile at 1:1 ratio. This report is based on an assessment study on water resources and cropping patterns in the NSDP.

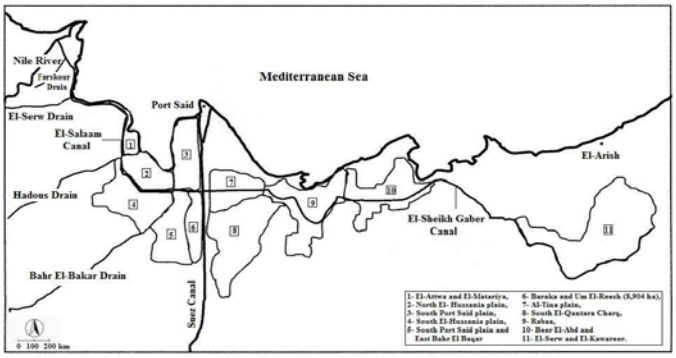

Figure 1 Eastern Nile Delta and North Sinai Development

In recommended crop rotation pattern, the crop intensity is 178% as compared to 167% under the crop rotation planned by planners of the scheme. Also, as small farmers pay the most attention for new land reclamation and cultivation, it is recommended to reallocate the reclaimed land and to increase the land share of small holders. Finally, it is recommended to apply irrigation with Nile water and drainage water at 2:1 instead of 1:1 ratio. This could then sustain the Egyptians' agricultural development.

2. Methodology The required data and detail activities conducted in the NSDP case study area consisted of: 1) Base maps for the study areas include canal, lakes, hydraulic structures, drains, ground water wells and pump stations were obtained as well as field visits were conducted for verification. 2) Related information to the water resources (location, discharge, served areas, water quality, cropping patterns) have been collected from the Ministry of Irrigation and Water Resources in Egypt and project area. 3) The meteorological data of NSDP areas were collected from different stations in El-Arish, Port Said, Suez and Ismailia cities. 4) Studies and Investigations of the farm field in El Tina Plain, North Sinai report done by Drainage Research Institute (DRI) and Water Management Institute (WMRI), 2006 had been studied.

3. Results The climate of the study area is typical of the arid zone, characterized by a long dry period (Ayyad et al., 1983). According to the FAO-56 Penman-Monteith, evapotranspiration rate (ET_o) was highest in July (7.8 mm d^{-1}) while the lowest values were observed in December and January (2.7 mm d^{-1}). It is clear that the main season is winter and the area under cultivation during the summer is significantly less compared to the winter season. Greater area under cultivation during the winter might be due to the less evapotranspiration (3.6 mm d^{-1}) and little rainfall during the growth season (average 7.8 mm d^{-1}). On the other hand, summer crops need greater volume and more frequent irrigation because the evapotranspiration is twice as high in summer (7 mm d^{-1}) as in winter. With the passage of time, farmers included new crops in the rotation. Therefore, re-assessment of the planned cropping pattern considering the interest of the local famers was needed. In this regard, a socio-economic study was recently conducted by (DRI) and (WMRI) of Egypt to assist the development of future agricultural plans for farmers in El-Tina Plain (DRI and WMRI, 2006). The result indicated that 67% of the selected farmers preferred agricultural crops such as cotton, rice, wheat and alfalfa, 21 % of the selected farmers preferred fruits, 8 % of the selected farmers preferred vegetables and only 4 % will be planting trees. Under recommended crop rotation plan, we suggest not only wheat and barley cultivation, but also Egyptian cotton because of its importance in the economy. To maintain the soil fertility, crops as clover (alfalfa) were also included in new cropping scheme.

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Table 1 shows that, the area used for cultivation by different stakeholders of Tina plain varied markedly from what was planned: small farmers (56.1%) > big investors (31.3%) > small investors (12.3%). In case of South Qantara, the distribution was: small farmers (54.5%) > big investors (26.2%) > small investors (19.3%). In general, 29.8 and 75.8 % of Tina plain and South of East Qantara areas were cultivated, respectively. It is clear from the data that the small farmers paid the most attention on the newly reclaimed soils and did maximum cultivation. Table 2 presents the computed water efficiencies under different soils for recommended cropping patterns in North Sinai. There is a big variation among selected crops in water use efficiency (WUE) due to difference in water consumptive use and crop productivity. The overall average WUE for the recommended cropping pattern was 5.14 kg m^{-3}. Data shows that, there is big difference between WUE data and water inflow efficiency (WIE). This is due to conveyance water losses. Also, there is difference between water inflows of different soils. Figure 2 shows the average TDS values of El-Serw, Faraskour, and Bahr Hadous drains from 1988 to 1998. The amount of total dissolved solids ranged from 992 to 2,896 mg L^{-1} with an average of 1,341 mg L^{-1}. A negative correlation was observed between Q and TDS. This relation can be used to predict the future water quality. Therefore, it can be inferred that the use of blending ratio 1:1 would be not a pragmatic approach for sustainable agricultural development under NSDP. Additional Nile water could be available from saved water through irrigation improvement projects in Egypt and/or upstream water conservation projects for entire Nile River basin.

Table 1 Allocation of privatized, cultivated, and prepared area (ha) in Sahel El Tina plain and south-east of Qantara to different investors up to March, 2007

Region	Category	Privatized areas	Cultivated areas	Processed areas for Agriculture	Prepared areas for planting
El Tina Plain	B. Investors	7,560	1,327	1,665	4,575
	S. Investors	2,110	525	532	1,053
	S. Holders	4,536	2,381	1,187	968
	Res. Farm	42	13	-	2,9.4
Total of Sahel El Tina		14,247	4,246	3,376	6,625
S of E. Qantara	B. Investors	4,775	2,915	21	1,695
	S. Investors	5,229	2,142	25.2	1,551
	S. Holders	9,116	6,048	37.8	225
Total of S of E Qantara		19,120	11,105	84	3,471
Total		33,367	15,351	3,460	10,096

Table 2 Water use and inflow efficiencies under different soils for recommended cropping patterns in North Sinai

Crop	Water use efficiency (Kg m^{-3})	Water inflow efficiency (Kg m^{-3})		
		Clay	Sandy	Loamy
Wheat	2.08	1.27	1.44	1.40
S. Clover	15.8	9.27	9.64	9.88
Barley	1.05	0.64	0.71	0.70
Sugar beet	11.3	7.01	-	-
Potatoes	9.26	-	6.16	-
Cotton	0.47	0.29	-	-
Rice	0.77	0.49	-	-
Sorghum	1.70	1.06	-	1.19
Maize	1.74	-	1.34	1.24
Vegetables	6.15	3.86	4.62	4.33
Potatoes	6.03	-	4.48	-
Soybeans	0.51	0.32	-	-
Fruits	2.34	-	1.68	1.60
L. Clover	12.8	-	8.34	8.32
G. efficiency	5.14	2.69	4.27	3.58

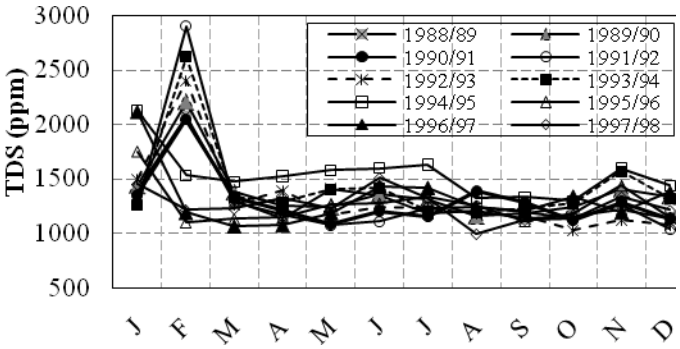

Figure 2 Monthly TDS values in drains of NSDP during 1988-98.

References

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