Country Report on Egyptian Agriculture

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ABSTRACT

The Egyptian Agriculture is one of the oldest agriculture civilizations in the world. Egypt occupies a total area of about 100 million hectares, out of this area, is about 3.1 million hectares as cultivated area covering three different production zones:

1. The old irrigated lands with an area of 2.3 millions hectares lying in the Nile Valley and Delta and most is fertile soils.
2. The newly reclaimed lands (0.8 million hectares included sandy and calcareous soils, the soil is poor in organic matter and macro-and micronutrients).
3. The rainfed area is about 0.1 million hectares of sandy soil located in the Northwest Coast and North Sinai.

On a per capita basis, the area of cultivated land is estimated at 0.05ha.Due to intensive cropping systems, the total cropped area is about 5.7 million hectares giving a cropping intensity of around 180% for the country as whole.

The agriculture sector in Egypt economy provides: 20% of Gross Domestic Product, 34% of the total exports, 32% of the total labor force and much of the Egyptian food Supply.

Agriculture in Egypt is almost entirely dependent on irrigation from the Nile, out of 55.5 billion cubic meters allocated to Egypt, 84% is used for agriculture. The annual per capita share of fresh water resources is now 930 cubic meters. This amount is expected to drop to 350 cubic meters by the year 2025.

Climate in Egypt is generally favorable all the year. Field crops cover 90% of the total cropped area and 10% for vegetables and fruit trees.

Egypt is considered to be a heavy user of chemical fertilizers especially nitrogen followed by phosphorous then potassium. The consumed amount of NPK in2002 was 488 kg/ha. The production of chemical nitrogenous fertilizers in 2002 in thousand tons was 1645 Ammonia, 1865 Urea and 1070 Ammonium nitrate, since the production of phosphate fertilizers also in thousand tons was 1670 Rock phosphate, 20 phosphoric acid, 940 single Super phosphate 15% P_2O_5 and 50 concentrated Super phosphate (37%P_2O_5), while the imported Potassium Sulfate (48% K_2O) was 80000 tons. The consumed, N: P2O5: K2O ratio was 63:12:1 in 1981 and declined to 36:5:1 in 2002 due to the high consumed SOP in the last 20 years.

1. Introduction

The responsibility of Egyptian Agriculture today is manifold. It has to meet the need of food for the rising population and to provide the raw materials required for industry and export. To achieve growth in food and agricultural production under the intensive system of cropping that prevails in Egypt, all measures to contribute the increase of soil productivity and fertility have to be mobilized and more effectively applied to reach this goal. The prospective view on world agriculture in the FOA study indicates the pressing need to intensify agricultural production on the already cultivated land and this will require much more intensive agriculture practices including the use of chemical fertilizers.

The Egyptian agriculture is one of the oldest agricultural civilizations in the world. The River Nile allowed a sedentary agricultural society to develop thousands of years. The agricultural sector now accounts for about 20% of both the Gross Domestic product (GDP), total exports 34 and about 32% of the total labor force, which means that the Egyptian economy still relies heavily on the agricultural sector.

The Nile Delta and a narrow strip of arable land alongside the Nile provide much of Egypt's food. The demand of food is increasing yearly due to the increase in population, which is projected to reach 98 million by 2025.

As a result of the situation, governmental policy and research programs are directed towards increasing total production. This requires increasing crop intensification and extensive use of inputs, particularly inorganic fertilizer, which results in increasing the pressure on the limited natural-resource base, mainly soil and water.

The Agricultural sector in Egyptian economy provides:

- 20 % of Gross Domestic Product
- 34% of the total exports
- 32% of the total labor force
- Much of the Egyptian food supply

2. Limited land resources

Egypt occupies a total area of about 100 million hectares. Out of this area, the agricultural land base is about 3.2 million hectares, covering three different production zones:

1-The old irrigated lands, with an area of 2.3 million hectares, lying in the Nile Valley and Delta. They represent the most fertile soils in Egypt.

2-The "newly" reclaimed lands, with a potential area of 0.8 million hectares. These include the newly reclaimed desert lands of sandy and calcareous origin, where soil is poor in organic matter and in macro and micronutrients.

3-The rainfed areas, with about 0.1 million hectares of sandy soil, located in the Northwest Coast and North Sinai.

On a per capita basis, the area of cultivated land in Egypt is among the lowest in the world, and is estimated at 0.05ha.

3. Scarcity of water

Agriculture in Egypt is almost entirely dependent on irrigation from the Nile. Of the 55.5 billion cubic meters (BCM) of Nile water allocated to Egypt, 84% is used for agriculture. Egypt's share of Nile water constitutes about 97% of its renewable water supply. The rest is from scattered rainfall along a narrow strip in the Western desert and Sinai.
The annual per capita share of freshwater resources is now 930 m^3. This amount is expected to drop to 350 m^3 by the year 2025. Therefore, the need to use non-conventional resources, such as agricultural drainage water and treated wastewater, becomes essential. Currently, about 4 billions m^3 of agricultural drainage water is officially reused for irrigation every year, with an average salinity of 1045 ppm.

4. Intensive cropping systems and excessive use of fertilizer

Agricultural land in Egypt is favorable to intensive agriculture. As a result of the optimum climatic conditions and a perennial intensity of irrigation water, crop yields are high. Due to intensive cropping the total cropped area is estimated at about 5.7 million hectares giving a cropping intensity of around 180% for the country as a whole.

At present, it is estimated that wheat, clover (berseem), cotton, rice, and maize account for 80% of the cropped area. Wheat and berseem are the principal winter crops. In summer, cotton and rice are important cash crops, while maize and sorghum are major subsistence crops.

5. Climate and general features of Egyptian agriculture

It has been reported that the mild rainy winter and hot dry summer of the Mediterranean type characterize the climate of the Mediterranean coastal areas including the Nile Delta. The climate of the rest of Egypt south Cairo is of the desert type. The climate in Egypt is generally favorable all the year round and suitable for growing a wide variety of crops. Field crops cover roughly 90%of the total cropped area and 10% for vegetables and fruits in the old and new reclaimed land.
Under the prevailing cropping patterns, in the2-or 3-year regular crop rotations; there are almost two crops a year in the same field giving a cropping index of 200 per cent whereas a cropping index of 300 per cent is for vegetable crop areas. The perennial sugarcane and permanent orchard areas have a cropping index of 100 per cent.

6. Characterization of Egyptian soils

The Egyptian soils varied with respect to their texture from sandy to heavy clay soils as shown in the table. Average value of total soluble nitrogen was low and organic matter was also low, the soil reaction was slightly alkaline. The available phosphorous values determined by Oslen's method were moderate. However, the available potassium ranged between low and high extracted by 1 N ammonium acetate solution. The DTPA extractable micronutrients (Zn, Mn and Fe) showed lower values of Zn in sandy soils and sandy calcareous soils, and adequate amounts of Mn and Fe in all tested soils.

Analysis of Egyptian Soils

Location	North Delta	South Delta	East Delta	West Delta	Middle Egypt	Upper Egypt
Texture	Clay	Clay loam	Sandy	Sand calcar.	Loamy clay	Loamy
pH (soil; water1:2.5)	7.9-8.3	7.8-8.2	7.6-7.9	7.7-8.1	7.5-8.1	7.7-8.2
T.T.S%	0.2-0.5	0.2-0.4	0.1-0.6	0.2-0.6	0.1-0.5	0.1-0.4
CaCO3	2.6-4.4	2.0-3.1	1.0-5.1	11.0-30.0	2.3-4.9	2.5-5.1
O.M%	1.9-2.6	1.8-2.4	0.4-0.9	0.7-1.5	1.5-2.0	1.2-1.9
Soluble N ppm	25.0-50.0	30-60	10.0-20.0	10.0-30.0	20.0-30.0	20.0-25.0
Available P ppm	5.4-10.0	3.5-16.5	2.0-20.0	1.5-10.5	2.5-20.0	3.0-18.o
Available K ppm	250-500	300-250	105-358	100-300	250-380	280-400
Available Zn ppm	0.5-4.0	0.6-6.0	0.5-1.2	0.4-1.5	0.8-3.9	0.5-4.0
Available Mn ppm	13.1-45.6	11.2-37.2	3.0-11.7	10.0-20.0	8.6-51.9	10.0-47.0
Available Fe ppm	20.8-63.4	19.0-27.4	6.7-16.4	12.0-18.0	13.0-37.0	12.4-40.8

7. Fertilizer requirements

Great efforts have been focused on tackling problems that lead to a significant increase in crop production. Among factors that may achieve such a target is the proper fertilization of different crops and this well obviously increase the demand for chemical fertilizers. Egypt utilizes fertilizers at an accelerating rate, especially nitrogen fertilizers followed by phosphate fertilizers then potassium fertilizers. This is due to various factors among which is the increase in cropping area, raising the rate of fertilizer application for various crops, and depletion of Nile irrigation water of some nutrients (K and micronutrients) after construction the High Dam.

Total Cropped area in 2002 (about 14 million feddan)

Crop	Area (feddan)	Crop	Area (feddan)
Cereals	6,363,000	Vegetables	1,296,776
Legumes	450,750	Fruits	1,660,663
Oil crops	377,438	Date palm	70,133
Sugar crops	454,634	Cotton	5oo,ooo
Potato	189,764	Forage crops	2,636,345

Feddan=4200 m^2

Numerous studies have definitely established the poverty of most Egyptian soils in organic matter and N content, but the P availability to plants ranged between sufficiency and marginality, although the total phosphorus content in most Egyptian soils is rather high. Potassium is moderate to high in old land, however there are sporadic responses to potassium fertilizer especially in case of some horticultural crops and on sandy and some calcareous soils.

The fertilizers requirements in Egypt are mainly estimated according firstly to the true pattern and the area allocated for each crop, and secondly the optimum economical rates of fertilizers for each crop which are obtained from average results of long-term trials conducted on each crop under different agro climatic conditions and depend on the nutrient amounts removed by this crop, see table.

Nutrient amounts (kg\ha.) removed by various crop plants

Crop	Yield MT/ha	N	P2O5	K2O	MgO	S
Barley	5	150	55	150	25	20
Maize	6	120	50	120	40	25
Rice	5	100	50	160	20	20
Sorghum	4	120	40	100	30	15
Wheat	6	170	75	175	30	30
Potato	40	175	80	31o	40	20
S.beet	45	2oo	96	300	90	35
Cabbage	70	370	85	480	60	80
Carrot	30	125	55	200	30	-
Cucumber	40	70	50	120	60	-
Eggplant	60	175	40	300	30	10
Lettuce	30	90	35	160	15	-
Okra	2o	60	25	90	35	10
Radish	20	120	60	12o	30	-
Onion & Garlic	35	120	50	160	15	20
Spanish	25	120	45	200	35	-
Tomato	50	140	65	190	25	30
Bean	2.4	155**	50	120	20	25
Horse bean	2.4	160**	45	120	20	-
Pea	2.0	125	35	80	15	
Apple	25	100	45	180	40	
Banana	40	250	60	1000	140	15
Citrus	30	270	60	350	40	30
Grape	20	170	60	220	60	30
Mango	15	100	25	110	75	-
Peanut	2	170**	30	110	20	15
Sesame seed	1	50	10	45	10	5
Rapeseed	3	165	70	220	30	65
Soybean	3	220**	40	170	40	20
Sunflower	3	120	60	240	55	15
Cotton (lint)	1	120	45	90	40	20
Sugar cane	100	130	90	340	80	60
Alfalfa	9	240**	65	170	40	25
Red clover	7	175**	45	140	50	20
****Leguminous plants can obtain most of their nitrogen from the air.**						

Other factors have to be taken into consideration in estimating fertilizer requirements such as:

1. Crop rotation and its effect on crop response to fertilizers.
2. The horizontal expansion in the newly reclaimed area.
3. Soil test values and plant tissue test.
4. The residual effect of fertilizers and organic manures.
5. Crop intensification, whether by increasing the plant number per unit area or by using the intercropping system.
6. The release of the newly promising varieties of various crops with high-yielding potential.
7. The nutritional balance for various crops
8. The fertilizing value of different sources of fertilizers
9. Improving the irrigation and drainage systems.

8. Fertilizer consumption

Egypt utilizes fertilizers at an accelerating rate, due to various factors such as the increase in the cropped area, raising the rate of fertilizer application for various crops and the depletion of Nile irrigation water of some nutrients after the construction of the High Dam. Consequently Egypt is considered to be a heavy user of chemical fertilizers, especially nitrogen fertilizers followed by phosphate fertilizers then potassium fertilizers which are the least consumed types of chemical fertilizers In Egypt as shown in Table.

Gradual increase in fertilizer rates for some field and horticulture crops

	N rate			**P rate**		**K rate**	
Crops	**(kg/feddan)**			**Kg P2O5/fed.**		**Kg K_2O/fed**	
	70/80	**81/90**	**91/2000**	**81/90**	**91/2000**	**81/90**	**91/2000**
Wheat	**38-50**	**60-75**	**75-90**	**15**	**15-22.5**		**24**
Cotton	**30-45**	**45-60**	**60-75**	**15**	**22.5**		**24**
Rice	**30**	**30**	**40-60**	**15**	**15**		**24**
Maize	**38-60**	**90-105**	**105-130**	**15**	**15-22.5**		**24**
F.bean	**7.5**	**7.5**	**15-20**	**15**	**22.5-30**		**24**
S.cane	**40-60**	**60-105**	**60-235**	**15-30**	**60**	**24-48**	**24-48**

Gradual increase in fertilizer rates for some field and horticulture crops

	N rate			P rate		K rate	
	(kg/feddan)			Kg P2O5/fed.		Kg K_2O/fed	
	70/80	81/90	91/2000	81/90	91/2000	81/90	91/2000
Tomato	45	90	125	15-30	45	24-48	24-48
Potato	45	90	125	15-30	60	24-48	24-48
Citrus	15-90	25-105	25-180	15-30	22.5-30	24	24-48
Grape	15-45	30-60	45-120	15-40	30-45	24	24-48
Mango	15-75	15-75	40-150	15-30	22.5-30	24	24-48
Apple	15-53	22.5-60	25-90	15-30	22.5-30	24	24-48
Banana	225	270	450	15-60	90	96	96-192

Amounts of fertilizer N, P and K consumed during the period 1965/66-2002

Year	N-fertilize (15.5%N) (in1000 t)	P-fertilize (15%P2O5) (in1000 t)	K-fertilizer (48%K2O) t	Total nutrient amount (kg/ha)
1965/66	1823	346	1458	136
1970/71	2122	329	3750	148
1975/76	2580	307	3958	179
1980/81	3665	693	19583	273
1981/82	4032	893	23711	303
1982/83	4252	953	20090	328
1983/84	4812	1066	36500	369

Cont.;

Year	N-fertilize (15.5%N) (in1000 t)	P-fertilize (15%P2O5) (in1000 t)	K-fertilizer (48%K2O) t	Total nutrient amount (kg/ha)
1984/85	**4922**	**1093**	**50400**	**380**
1985/86	**4990**	**1219**	**50800**	**392**
1986/87	**5013**	**1233**	**60200**	**397**
1988/89	**5174**	**1200**	**63204**	**405**
1989/90	**5226**	**1100**	**60000**	**402**
1993	**5682**	**955**	**60000**	**421**
2002	**6750**	**955**	**60000**	**488**
Source: Principal Bank for Develoment & Agricultural credit-Fertilizer administration				

- From the data reported in this table, the ratio of N:P2O5:K2O was 60:11:1 in 1980/81 and declined to 36:7:1 in 2002 since the consumed amount of K-sulfate increased from 19,583 tons in1980/81 to 60,000 tons in 2002 and this had positive effect on the balance among the three nutrients.
- Zinc sulfate fertilizer has been introduced to the Egyptian farmers particularly for bady nurseries. About 1500 tons of Zn-sulfate are usually consumed. Also about 18,656 tons of compounds and foliar fertilizer of Zn, Fe, Mn and Cu are consumed for field and horticultural crops especially those grown in the newly reclaimed soils.

9. Domestic fertilizer production

The Egyptian production of nitrogenous fertilizers increased from 692000 tons of N-fertilizer 15.5% N in 1962 to about 10400 thousand tons in 2001.
Phosphorus fertilizer also increased from 156000 tons of P-fertilizers (15%P2O5) in 1962 to about 1200 thousand tons in 2001.
At present, Egypt have five plants for the production of nitrogen fertilizers: Abu Qir, Suiz, Kima, Talkha and El-Nasr Coke, and three plants for phosphate fertilizers: Abu Zaabal, Kafr El-Zayat and Manqabad.
The production of all these plants covers our requirements of both nitrogen and phosphorus fertilizers and the surplus of these fertilizers especially urea and ammonium nitrate fertilizers-is exported to some African and European countries.
Egypt also owned the raw materials for nitrogen and phosphorus fertilizer industry.

Chemical fertilizer amount produced in 2002 (in 1000 tons)

Fertilizer	Production	Export	Import	Consumption
Ammonia	2177	93	-	2056
Urea	2382	952	-	1335
AN	1383	101	-	1282
Ca(NO**3)3***	NA	NA	NA	NA
AS**	108	NA	NA	NA
Rock phosphate	972	265	-	737
Phosphoric acid	22	0	-	20
Single sup.Phos	971	105	-	977
Trip sup.Phos	48	0	-	34
K-fertilizers	-	-	12	30
Compound Fertilizers				
MAP	-	-	-	-
DAP	-	-	-	-
NPK	-	-	-	-
Mixed Fert.	7	-	-	-
Liquid Fert.	30	-	-	-

10. Results from long term experiments

Series of simple long-term trials were carried out during the period 1981-1990 at 5 Governorates namely El Monofia (10 trials), El-Gharbia (16) El-Sharkia (15) Beni Seweef (15 trials) and El-Menia (8 trial) to study the effect of K-addition on the farmer fields and under his prevailing crop rotation.

K-treatments (with and without potassium): recommended rates of nitrogen and phosphorus for every cultivated crop were added in the proper time and method.

The table below summarized the obtained yield for every crop under with and without K-application in MT/ha, and the increase over without K, as well as, the total number of field trials and number of experiments with significant effect of K-application.

Effect of K-fertilizer on production of some crops under the Egyptian condition between 1981-1990

Crops	No. of experiments		Yield MT/ha		Yield increase over 0-K	
	Total	With sign. eff.	+K	0-K	MT/ha	%
Cotton	121	42	3.58	3.38	0.20	6
Soybean	29	9	4.08	3.66	0.42	11
Rice grain	48	23	7.75	7.18	0.57	8
Maize grain	347	77	5.59	5.36	0.23	4
Wheat grain	198	92	5.14	4.75	0.39	8
Berseem t/ha.cut	163	80	29.24	27.52	1.72	6
F.Bean grain	137	47	4.26	3.91	0.35	9
Orange seedless	3	3	31.40	25.30	5.10	20
Grape (Rosine)	3	3	12.33	15.50	3.17	25
Total	1049	376				

Each kg K2O increased the crop yield as follows.

		VCR
Wheat grain yield	3.33 kg	2.3
Rice grain yield	4.75 kg	2.0
Maize grain yield	2.08 kg	--.
Faba bean grain yield	2.79 kg	6.6
Soybean grain yield	3.50 kg	2.7
Seed cotton yield	1.67 kg	4.0
Berseem fresh weight	57 kg	9.1
Orange Fruits	30 kg	7.5
Grape Fruits	27 kg	8.5

Effect of P and K fertilization on soybean grain yield (means of 14 trials)

N	P2O5	K2O	Grain yield		Protein yield	
			MT/ha	%	Kg/ha	%
37	0	0	3.53	100	1.35	100
37	0	60	3.84	109	1.52	113
37	60	0	3.97	113	1.65	122
37	60	60	4.38	124	1.76	130

Effect of K fertilization on grain and crude protein of faba bean (means of 13 trials

N	P2O5	K2O	Grain yield		Crude protein	
Kg/ha			MT/ha	%	Kg/ha	%
37	72	0	4.59	100	13o5	100
37	72	120	5.00	109	1505	115

Effect 0f NPK fertilization on grain yield and crude protein of wheat grain

N	P_2O_5	K_2O	Grain yield		Crude protein yield	
Kg/ha			MT/ha	%	Kg/ha	%
105	36	0	4.55	Control	535.4	Control
140	36	0	5.15	+13%	597.2	+12%
175	36	0	5.26	+16%	618.9	+16%
175	72	0	5.11	+12%	608.9	+14%
175	72	120	5.51	+21%	646.4	+21%

Effect of K-Fertilization on orange production

Treatment			Loamy soil		Clay soil	
N	P2O5	K2O	1985-1987		1985-1986	
Kg/ha			MT/ha	%	MT/ha	%
428	107	0	25.1	100	18.9	100
428	107	120	31.2	124	24.0	127
428	107	180	31.3	125	-	-
422	107	240	30.5	121	26.0	138
Variety			Navel orange		Sweet orange	

Effect of K-fertilization on grape production

Treatments			Sandy calcareous soil		Clay soil	
N	P2O5	K2O	1982-1984		1984/1986	
Kg/ha			MT/ha	%	MT/ha	%
285	107	0	22.3	100	10.0	100
285	107	120	25.2	113	12.5	125
285	107	240	23.3	104	16.7	167
Variety			Red Roma		Sultanen	

Effect of K and P fertilization on grape yields. (Variety: Red Rome, grown on sandy calcareous soil)

Treatment			1982	1983	1984	Aver	% over
N	P2O5	K2O	yield				
Kg/ha			MT/ha				Control.
330	-	-	25.70	14.08	17.81	19.20	
330	100	-	26.80	21.11	18.25	22.25	16
330	-	100	27.00	21.11	21.29	23.13	20
330	100	100	30.20	22.22	23.06	24.08	25
L.S.D		5%	n.s	n.s	n.s		
C.V		**%**	**10**	**13.5**	**9.7**		

- **N.B: Plot area was 400 m2 (90 trees, 4 years old), replicated 3 times.**
- **P and K fertilization were splitted into two equal doses, one at the first irrigation (end Feb.), the other one, one month later.**

Effect of K-addition in Sugar cane in Egypt

Middle Egypt area						
N.P	K2O	**ratoon1**	**ratoon2**	**ratoon3**	**ratoon4**	Average
Kg/ha		MT/ha				
N.P	0	186.6	164.5	143.1	190.2	161.1
N.P	120	194.0	177.0	162.1	172.8	176.5
Difference %		4	8	13	15	10
Upper Egypt area						
N.P	0	113.4	74.8	83.1	-	90.4
N.P	120	116.5	85.0	99.8	-	100.4
Difference %		3	14	20	-	11
Sucrose was also increased by 1%						

The effect of Potassium on Drought Resistance in crop production Under the Egyptian Conditions

Series of long-term experiments were carried out during the period of 1992 to 1995 at eastern part of Nile Delta (sandy and sandy loamy soils) to study the efficiency of potassium at 4 levels (K0, K120, K240 and K360 kg K2O/ha) on crop production under saline and water stresses.

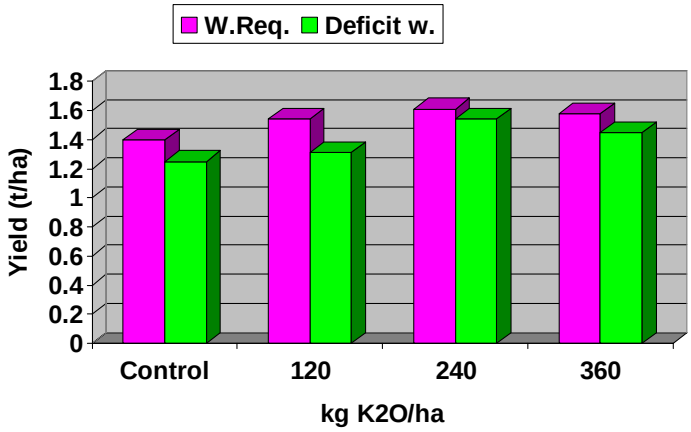
Three methods of irrigation (sprinkler, drip and surface irrigation) with required and deficit irrigation water amounts were used.

The table below summarized the obtained results**.**

The obtained results

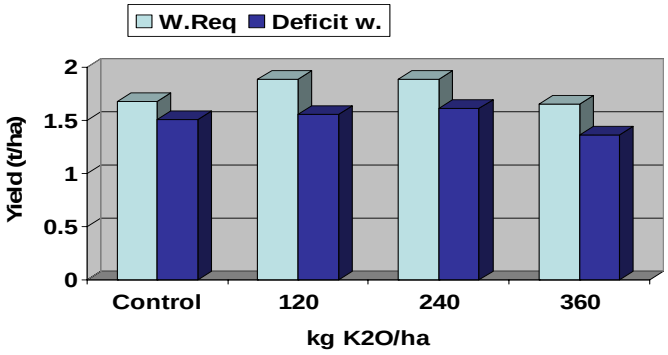
Crops	Effect of		KxIrr.interaction	Best K*Tr.,	Max.yield increase % of	
	K	No.,Irrig			Req. irr.	Def.irr.
Sprinkler Irrigation						
Alfalfa	s	hs	ns	120	9.30	5.60
Drip irrigation						
Garlic	hs	hs	hs	240	75.00	36.00
V.faba	ns	hs	ns	12o	42.50	25.00
Garlic	ns	hs	ns	120	16.50	43.00
Surface irrigation						
Wheat	ns	hs	ns	-	18.00	56.00
Sesame	hs	s	ns	240	24.00	31.00
V.faba	hs	hs	ns	240	11.00	23.00
Gr.nut	hs	hs	ns	240	8.90	23.00
Sesame	s	hs	ns	240	12.50	6.60

Effect of different levels Potassium and irrigation on Groundnut yield (t/ha) at Kasseen



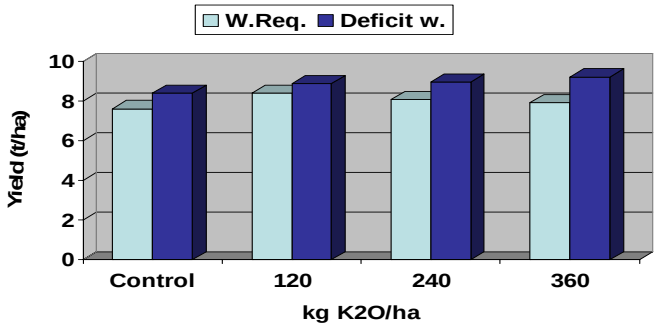
LSD(5%):
K-Fertlization=0.07 t/ha Irrigation=0.05
K*irrigation=ns C.V=5.1%

Effect of different levels of Potassium and irrigation on Sesame yield (t/ha) at Kasseen



LSD(5%):
K-Fertlization=0.17 t/ha Irrigation=0.12
K*irrigation=ns C.V=10.2%

Effect of different levels of Potassium and irrigation on Rice yield (t/ha) at ElSerw



Effect of different levels of Potassium and irrigation on Cotton yield(lint+seed) t/ha at ElSerw