The potentiality of rape as an oil crop in Egypt covering the gape of import of fat and oil commodities

Mahmoud K. Tahoun

Faculty of Agriculture, Alexandria University El-Shatby, Aflatoon Street, Alexandria, Egypt.
Fax: 002035922780 Email: samehgene@yahoo.com

Abstract

The chronic shortage of edible oil in Egypt has persisted unabatedly for the last few decades. Edible oil continues to be a major national import. This crisis requires a planned expansion of oil crop research and development to increase domestic production. Rapeseed as a source of edible oils has become the third oil crop in the world. Production of canola oil on economic scale in Egypt is still not yet matured; hence rape competes with major strategic winter crops such as wheat and clover. Movement to new reclaimed areas in Egyptian deserts as South Tahrir province and the North-West Coastal region of the Mediterranean Sea enabled the production of canola oil seeds on experimental scales at 1308 and 635 kg fa^{-1} on rain fed complemented with sprinkling irrigation and rain fed systems, respectively.

Key words: Rapeseed, canola oil quality, production, rain fed irrigation, sprinkling irrigation.

Introduction

The consumption of edible oils and fats in Egypt grows dramatically. The annual production of fat and oil commodities is ~ 180000 metric tons, while the volume of their import has recorded ~ 385759 metric tons (FAO year book, 2000). Therefore, it was necessary to search for new indigenous sources for oil rather than dependence on import. For centuries, Brassica has been domesticated and its oil composition was modified by man to meet changes in human needs. For strategic reasons, rape may be considered as a competitor with major winter crops; wheat and clover. Thus, it is necessary to search for new cultivable areas outside the old Nile Valley for growing rape as an economic oil crop. At the beginning, adaptation, selection breeding program was achieved (Tahoun et al., 1999). The first trial of growing rape at new reclaimed areas was achieved at South Tahrir Province (Tahoun and Adam, 2003). While, the second approach was realized at the University of Alexandria desert farm in the North-West Coastal region (Tahoun, 2007), where irrigation depends mainly on rain fall in winter ~ 142.6 mm allover the year.

Materials and methods

Materials

For selection and breeding aspects, twenty five rapeseed accessions belonging *B. carinata, B. rapa (campestris), B. nigra, B. napus* and *B. juncea* from regional plant introduction station, Iowa State University, U.S.D.A were used and selected for oil content and the fatty acid composition. *Brassica napus* acc. 17 proved to be the best as it gave oil of high physical organoleptic properties and showed 0.00 % erucic acid as well as lower linolenic acid content < 10%.

Methods

Brassica napus acc. 17 was grown at South Tahrir Center, Desert Development Center (D.D.C.) Fig. 1, the American University in Cairo; where the soil is sandy-loam, poor in organic matter and contains low content of soluble salts and trace elements Zn, Mn, Cu and Fe. Sprinkling irrigation was used to complement the scarce rainfall, which averages ~42 mm allover the year. The second location was at the University of Alexandria desert farm at El-Hamam Province, which is a part of the North-West Coastal region of the Mediterranean Sea; Fig. 2, where the soil consists of two layers; 0-20cm is clay, while the second 20-40cm is clay-loam with salinity value of an EC 5 to 8 ms/cm and a pH of 7.5 to 8.8. The experiment was divided into two sub-experiments: in the first, rape was grown under rain fed ~ 142.6 mm allover the year; Fig. 2, while in the second surface irrigation was carried out with drainage water available EC 8.0 ms/cm (2560 ppm). For comparison, rape was cultivated at the Faculty of Agriculture Experiment Station at El-Sabahia zone by Alexandria City. The soil is a part of the Nile Valley, which is clay-loam, rich in available P and very poor in K and organic matter. Surface irrigation was achieved with the Nile water during the whole course of growing the crop. Phosphorus fertilization in the form of calcium monophosphate and commercial sulphur were added at 30 kg P_2O_5 and 50 kg S fa^{-1} (Faddan = 4200 m^2), respectively. Nitrogen was added at 40 kg fa^{-1}, while potassium was added at 95 kg K_2O fa^{-1}. Seeding rate was 2.5 Kg fa^{-1} on ridges 60 cm width in hills with hill spacing 15 cm.

Oil content of rapeseeds was determined on the basis of dry weight from a random sample. Soxhlet oil extraction was used with n-hexane for 8hr, (A.O.A.C. 1980). The fatty acid composition of extracted oils was measured by gas chromatography according to Tahoun and Ali (1981).

Results and discussion

Evaluation of the five species and twenty five accessions belonging to the family *Brassicaceae* was achieved with special emphasis on the oil content and the fatty acid composition each accession, Table 1. *Brassica carinata* acc. 5, *B. rapa* acc. 8 and *B. nigra* acc. 13 exhibited the highest oil contents 43.8 - 44.97 %. On the other hand, *B. napus* accessions 16 and 18 revealed the lowest seed oil contents 26 %. The fatty acid composition of the oils different accessions indicated negative relationship between the concentrations of erucic acid $C_{22:1}$ and the sum of oleic, linoleic and linolenic acids content each rapeseed variety. *Brassica napus* acc. 17 that grows naturally in South Korea is the only rapeseed cultivar indicating 0.00 % erucic acid, while *B. rapa* acc. 10 and *B. napus* acc. 17 contained < 10 % linolenic acid that affects the durability of the oils. Moreover, the oil of the latter accession supered the physical properties of the oils extracted from other species and accessions.

Harvesting of accession 17 grown in winter under experimental scales was achieved at the first week of May, where the full growth period is ~ 180 days. Rapeseed yields after threshing and cleaning varied from one location to another as a matter of any differences in soil and water qualities as well as the amount of water consumed during the whole period of crop maturation. Growing *B. napus* acc. 17 at the North-West Coastal region under rain fed regime ~142.6 mm allover the year, gave yield of 635.5 kg fa^{-1} against 746.7 kg fa^{-1} that being obtained under rain fed complemented with surface irrigation with drainage water (E C 4.0 to 8.1 ms/cm) available there. At South Tahrir Province, a yield of 1308 kg fa^{-1} was recorded, where irrigation is complemented beside rain fed ~ 42 mm allover the year with sprinkling irrigation. Above yield shown at South Tahrir province is quite similar to that 1489.7 kg fa^{-1} obtained by growing *B. napus* acc. 17 at El- Sabahia Agricultural experiment station, which is a part of the old Nile valley. The difference in rapeseed productivity between South Tahrir Province (1308 kg fa^{-1}) and North-West Coastal region (6.35.5 or 746.7 kg fa^{-1}) can traced back to the difference in the amount of water utilized in each case for crop maturation rather than to be due to any differences in soil quality at each location.

In addition to the suitability of the above reclaimed areas for growing and production of canola oil quality rapeseed, Sinai includes a new promising area of six hundred thousands faddan that can be utilized for growing rapeseeds, where irrigation is fulfilled through El- Salam Canal. Beside above for normal irrigation, Yakout and Greish (2003) as well as Selim (2003) succeeded in growing *B. napus* L (Maas 1990) at South Sinai, where agriculture there suffers from both salt affected soil and underground brackish water that contains varying amounts of dissolved salts used for irrigation in middle Sinai.

Conclusion

As a matter of competition between rapeseed and major winter crops; wheat and clover, and hence there is no more available agricultural areas for cultivation of rape in winter as an oil crop, it was necessary to search for new reclaimed agricultural areas for economic production of canola oil rapeseed.

Rapeseed was successfully cultivated on experimental scales at South Tahrir Province and at the North-West Coastal region of the Mediterranean Sea, where irrigation is performed at the first with sprinkling system and under rain fed at the second ~ 142.6 mm allover the year. The seed yield was found to be affected by the amount of water available for irrigation; however, the North-West Coastal region affords ~ 234050 faddan that can be utilized for growing rape.

A new agronomic program is being established for reclaiming and cultivation of six hundred thousands faddan in Sinai on water supplied from the river Nile through El- Salam Canal.

References

Association of official agriculture chemist's (AOAC, 1980) 11th ed., Washington D.C., USA.
Food and Agriculture Organization (FAO, 2000) Trade year book vol. 54 pp. 284 – 315.
Maas, E. V. (1990) Crop salt tolerance. Inc. Tani-kk (ed). ASCE. Manual and Reports on Engineering practice. No. 71, pp. 262 – 304 New York, NY.
Selim, M. M. (2003) Proceeding's of the 11th International Rapeseed Congress No. 3 pp. 963 – 965.
Amin, E. Aly, Abdel-Halim, Ghazy and Mahmoud K. Tahoun (1999) Proceeding's of the 10th International Rapeseed Congress. Canberra, Australia. P. 210.
Tahoun, M. K., Adam, M. O. (2003) Proceeding's of the 11th International Rapeseed Congress. Copenhagen, Denmark. No. 2. P. 365 – 367.
Tahoun, M. K. (2007) Proceeding's of the 12th International Rapeseed Congress. Wuhan, China.
Tahoun, M. K. and Ali, H. (1981) Milchwissenschaft 36: 419.
Yakout, G. M. and Greish, M. H. (2003) Proceeding's of the 11th International Rapeseed Congress. Copenhagen, Denmark. No.3. p. 966.

Table 1

Mean values of oil content (%) and the Fatty acid composition of *Brassica* species and accessions

Species and accessions	Source country	Common name	Oil content in seed (%)	Fatty acids			
			1997	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$	$C_{22:1}$
Brassica carinata							
1	Poland	NU 51639	35.30 hijk	18.2	19.9	19.6	22.4
2	Puerto Rico	-	37.37 fghi	16.2	13.9	21.1	32.9
3	Ethiopia	-	40.40 def	8.9	12.8	21.1	48.4
4	Ethiopia	NU 51467	39.17 efg	9.4	17.7	27.0	36.8
5	Ethiopia	-	43.80 bc	10.3	17.0	22.0	45.4
Brassica rapa (campestris)							
6	Argentina	NABO	39.17 efg	21.8	13.5	20.4	35.4
7	Canada	CANASPAN	33.50 jk	10.1	13.5	20.2	46.2
8	Afghanistan	K-1071	43.80 bc	10.0	24.6	17.9	40.5
9	Canada, Manitoba	POLAR	39.27 efg	16.2	19.8	27.9	18.0
10	New Zealand	Green resistant	37.60 fgh	15.7	24.5	7.0	37.4
Brassica nigra							
11	India	IB 330	42.85 bcd	24.3	20.5	15.2	32.0
12	Yugoslavia	ELEV 900 M	36.02 hij	11.7	16.0	24.8	34.2
13	India	-	44.97 a	12.5	11.0	23.0	42.9
14	Delhi, India	-	42.82 b	10.5	22.2	22.7	32.9
15	Turkey	-	34.55 ijk	11.4	22.1	20.2	35.5
Brassica napus							
16	South Korea	Dwarf Essex	26.32 l	9.5	9.6	19.6	48.0
17	South Korea	Dong Hae 10	41.60 cde	0.0	16.4	11.4	0.0
18	Germany	Santana	26.22 l	22.0	23.5	17.6	31.0
19	South Korea	Yonkoku Ban	41.90 cde	12.0	19.9	15.1	37.0
20	Sweden	Brink	32.87 k	30.8	21.8	23.5	15.8
Brassica juncea							
21	Pakistan	K-569	41.72 cde	13.4	17.2	18.0	42.7
22	Afghanistan	-	42.15 bcde	20.2	15.4	15.3	31.7
23	India	In. 48151	37.30 ghi	26.4	14.3	22.7	24.2
24	Turkey	-	33.20 jk	24.4	21.7	14.0	32.0
25	China	O 63	32.75 k	19.0	24.2	26.8	21.3
L.S.D. (0.05)			3.04				

Means with the same letter(s) are not significantly different at 0.05 level of probability.

Table 2: Soil categories and their qualities of the North-West Coastal region, ~350 Km east – west and ~50 Km, depth to the South.

Soil Classes	Area	
	Faddan	%
Soils suitable for all kinds of crops	203875	8.66
Soils suitable for crops with medium roots	36850	1.56
Soils suitable for crops with surface roots	139375	5.92
Coastal soils for growing crops with surface roots	10600	0.46
Rocky soils	1538260	65.35
Salty soils	47225	2.02
Soil interacted units	375500	15.93

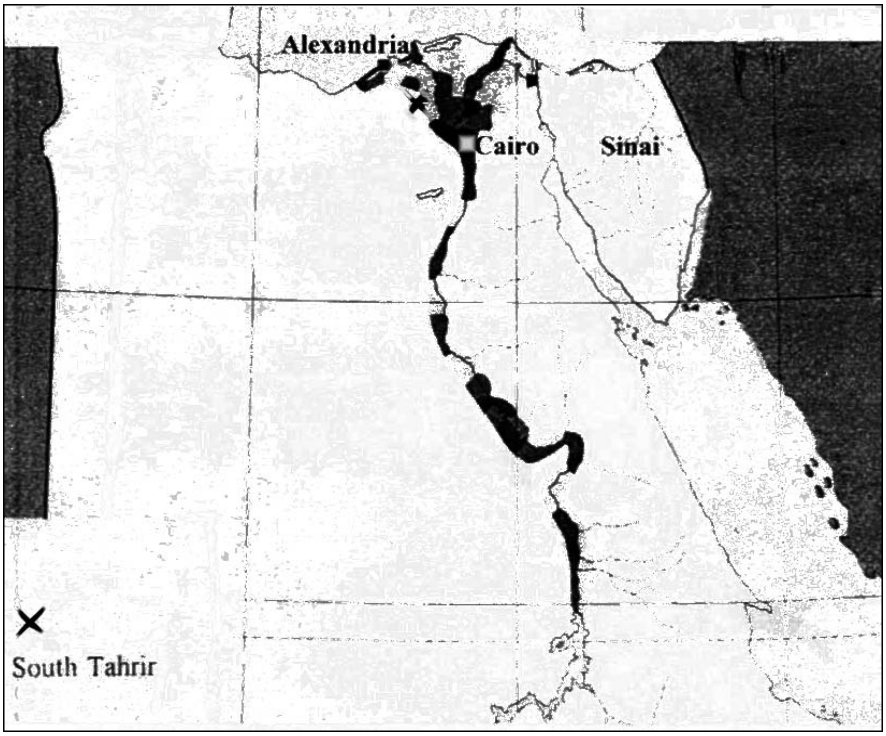
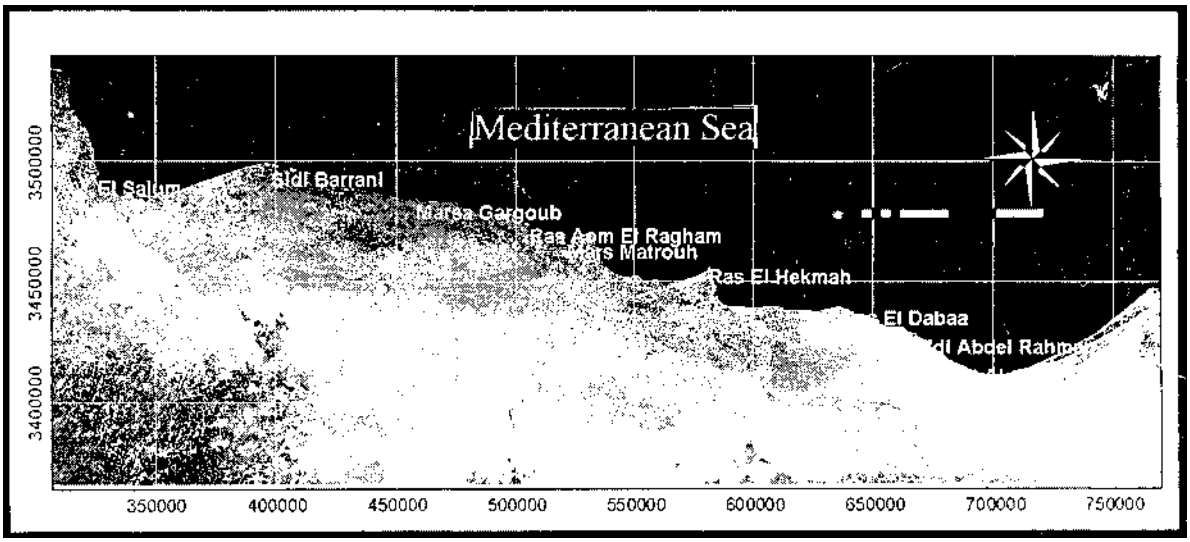
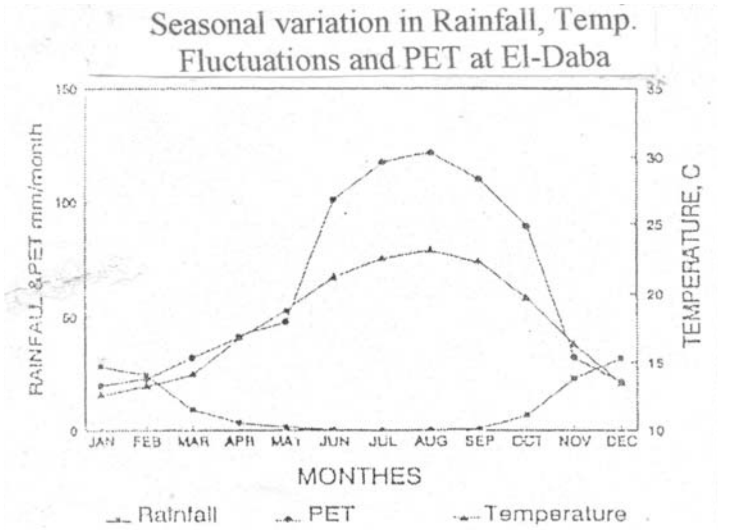
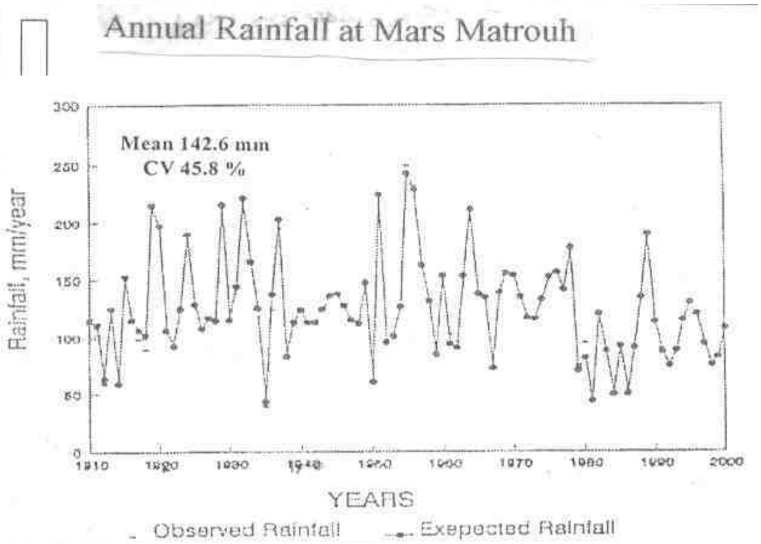


Fig. 1: Location of South Tahrir Province.

The NW Coastal zone of Egypt extends 350 Km from west of Alexandria to the Libyan border and houses about 320,000 agropastoralists




Seasonal variation in Rainfall, Temp.
Fluctuations and PET at El-Daba
RAINFALL &PET mm/month
TEMPERATURE, C
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
MONTHES
Rainfall
PET
Temperature


Annual Rainfall at Mars Matrouh
Mean 142.6 mm
CV 45.8 %
Rainfall, mm/year
1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
YEARS
Observed Rainfall
Exepected Rainfall