



## SCENARIO OF OILSEED CROPS ACROSS THE GLOBE

S. K. Rai\*, Deeksha Charak and Rajeev Bharat

Division of Plant Breeding and Genetics, Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu (Jammu & Kashmir), India.

### Abstract

India is one of the largest producers of oilseeds in the world and occupies an important position in the Indian agricultural economy. There are nine important oilseeds crops grown in India out of which seven are of edible oils (soybean, groundnut, rapeseed mustard, sunflower, sesame, safflower and niger) and two are of non-edible oils (castor and linseed). In terms of acreage, production and economic value, oilseeds are second only to food grains. India ranks first in the production of groundnut, third in rapeseed-mustard and fifth in soybean.

**Key words** : Oilseeds, acreage, production, economy.

### Introduction

Indian vegetable oil economy is the fourth largest in the world. The country accounts for 12-15% of global oilseeds area, 6-7% of vegetable oils production (next to U.S.A, China and Brazil) and 9-10% of the total edible oils consumption (FAO, 2011). Currently, India accounts for 6.8% of the oil meal production, 5.9% of the oil meal export, 6.1% of the vegetable oil export, 9.00% of the vegetable oil import and 9.3% of the edible oil consumption of the world (Sonnad *et al.*, 2011). India ranks first in the production of most of the minor oilseeds (castor, niger, safflower and sesame). In the case of major oilseeds, India ranks first in the production of groundnut, third in rapeseed-mustard and fifth in soybean.

All India Crop/Season-wise Area, production and yield of oilseed crops during XIth plan period released by Directorate of Economics & Statistics, GOI, New Delhi is given in table 1.

### Soybean

Soybean (*Glycine max*) is the world's most important seed legumes which contributes 25% to the global edible oil. The seeds are used for direct human consumption, and as an oil and protein source (Weiss, 1983). Additionally, plant residues are extremely important as fodder for cattle in many regions of the world (Savage *et al.*, 1994). In Africa and Asia, groundnut is intercropped between maize, sorghum, and soybean or, in a few areas, between

mature coconut trees (stalker *et al.*, 1987). The commercial cultivation of soybean crop in India in has reached to 9.21 million ha in 2010. Similarly, the production and productivity levels increased to 10.4 million tonnes and 1200 kg/ha in 2010, respectively. India's share in world production of Soybean is only 3%. Soybean is the third largest oilseed crop in India next only to Groundnut & Mustard. The production of soybean is hovering around 99.054 lakh tonnes during 2008-09 to 127.364 lakh tonnes during 2010-11 (DOD, GOI, Hyderabad, 2014).

Area, production and yield of major crop growing States.

(Average of 2007-08 to 2011-12) \*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Soybean	Madhya Pradesh	53.454	61.374	1148
	Maharashtra	28.970	34.429	1188
	Rajasthan	8.136	10.590	1302
	Andhra Pradesh	1.288	1.848	1435
	Karnataka	1.580	1.178	746
<b>Total soybean</b>		<b>95.675</b>	<b>111.576</b>	<b>1166</b>

\*source: (DOD, GOI, Hyderabad, 2014).

**Table 1** : Area, production and yield of oilseed crops during XIth plan period.  
(Area in lakh ha; Production in lakh tonnes and Yield in Kg/ha)

<b>Crop</b>		<b>2007-08</b>	<b>2008-09</b>	<b>2009-10</b>	<b>2010-11</b>	<b>2011-12</b>	<b>2012- 13*</b>	<b>2013-14**</b>
Groundnut	A	62.920	61.649	54.775	58.563	53.143	47.21	64.82
	P	92.825	71.681	54.286	82.648	69.329	46.95	92.73
	Y	1459	1163	991	1411	1305	994	1430
Soybean	A	88.817	95.108	97.348	96.010	101.790	108.41	102.30
	P	109.682	99.054	99.645	127.364	122.824	146.66	119.89
	Y	1235	1041	1024	1327	1207	1353	1172
Rapeseed-Mustard	A	58.255	62.981	55.880	69.005	59.151	63.63	72.25
	P	58.336	72.007	66.081	81.788	67.756	80.29	79.60
	Y	1001	1143	1183	1185	1145	1262	1102
Sunflower	A	19.116	18.128	14.765	9.290	7.219	8.30	5.80
	P	14.631	11.580	8.507	6.511	4.999	5.44	5.47
	Y	765	639	576	701	692	655	943
Safflower	A	3.203	2.946	2.878	2.439	2.418	1.84	1.01
	P	2.245	1.892	1.788	1.505	1.205	1.09	1.14
	Y	701	642	621	617	498	591	1129
Castor	A	7.869	8.662	7.349	8.804	14.693	12.34	11.20
	P	10.536	11.710	10.089	13.504	23.392	19.64	16.89
	Y	1339	1352	1373	1534	1592	1592	1508
Sesamum	A	17.991	18.091	19.420	20.832	19.170	17.06	6.52
	P	7.569	6.403	5.885	8.929	8.210	6.85	6.75
	Y	421	354	303	429	428	402	1035
Linseed	A	4.679	4.080	3.420	3.592	3.208	2.96	1.17
	P	1.634	1.692	1.537	1.465	1.407	1.49	1.43
	Y	349	415	449	408	439	502	1222
Niger	A	4.076	3.934	3.755	3.711	3.640	3.10	0.80
	P	1.095	1.170	0.999	1.077	1.000	1.02	0.89
	Y	269	297	266	290	275	325	1112
<b>Total Oilseeds</b>	<b>A</b>	<b>266.926</b>	<b>275.579</b>	<b>259.590</b>	<b>272.244</b>	<b>264.432</b>	<b>264.85</b>	<b>265.6</b>
	<b>P</b>	<b>297.553</b>	<b>277.189</b>	<b>248.817</b>	<b>324.791</b>	<b>300.122</b>	<b>309.43</b>	<b>324.7</b>
	<b>Y</b>	<b>1115</b>	<b>1006</b>	<b>958</b>	<b>1193</b>	<b>1135</b>	<b>1168</b>	<b>1222</b>

**Source:** \*Production according to Final estimates and \*\*4<sup>th</sup> advance estimates  
(Directorate of Economics & Statistics, GOI, New Delhi)

\*\*Area according to SEA of India

Madhya Pradesh and Maharashtra contribute about 86% of total soybean area and production.

### Area, production and yield of major crop growing countries.

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; production in lakh tonnes; yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Soybean	USA	295.784	837.602	2832
	Brazil	221.716	637.215	2874
	Argentina	172.064	452.541	2630
	China	86.474	145.640	1684
	India	95.675	111.576	1166
<b>Total soybean (world)</b>		<b>967.666</b>	<b>2400.345</b>	<b>2441</b>

\*source: (DOD, GOI, Hyderabad, 2014).

India ranks 5<sup>th</sup> globally in respect soybean cultivation after China, however, the yield of soybean in India are far below compared to that of major soybean countries.

### Groundnut

Groundnut (*Arachis hypogaea* L.) is the 3<sup>rd</sup> most important oilseed crop of the world cultivated in 96 countries of world (Upadhaya *et al.*, 2003). A native of South America, it is cultivated in tropical, sub-tropical, and warm temperate regions of the world. The seeds are used for direct human consumption and as an oil and protein source (Weiss, 1983). Additionally, plant residues are extremely important as fodder for cattle in many regions of the world (Savage *et al.*, 1994). In Africa and Asia, groundnut is intercropped between maize, sorghum, and soybean or, in a few areas, between mature coconut trees (Stalker *et al.*, 1987). The 68% of groundnut cultivated world-wide is produced in Asia (23 Mt), 24% in Africa (8 Mt) and the remaining 8% (3.5 Mt) from North America, the Caribbean, Europe and Oceania (Dwivedi *et al.*, 2003). India accounts for about 27% of global area and contributes 19% to world groundnut production. Groundnut production in following five Indian states account for about 90% of the total groundnut area.

### Area, production and yield of major crop growing States.

(Average of 2006-07 to 2010-11)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Groundnut	Gujarat	18.157	27.600	1520
	Andhra Pradesh	15.582	14.932	958
	Karnataka	8.202	5.946	725

	Tamil Nadu	4.419	9.737	2204
	Rajasthan	3.378	5.710	1691
	Maharashtra	3.406	3.994	1173
<b>Total groundnut</b>		<b>58.108</b>	<b>74.015</b>	<b>1274</b>

\*source: (DOD, GOI, Hyderabad, 2014).

Gujarat and Andhra Pradesh States are major groundnut growing States contributing about 58% and 57% to the total groundnut area and production, respectively.

### Area, production and yield of major crop growing countries.

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Groundnut	China	43.712	148.017	3386
	India	58.108	74.015	1274
	Nigeria	24.615	30.903	1255
	USA	4.966	18.493	3724
	Myanmar	8.308	13.286	1599
	Indonesia	6.158	8.813	1431
<b>Total groundnut (World)</b>		<b>234.897</b>	<b>383.196</b>	<b>1631</b>

\*source: (DOD, GOI, Hyderabad, 2014).

India ranks first in area coverage of groundnut crop but average productivity is quite low and is nearly a third of those of USA and China and even lower than that of the world the production-wise.

### Rapeseed-mustard

Brassica (rapeseed-mustard) is the second most important edible oilseed crop in India after groundnut and accounts for nearly 30% of the total oilseeds produced in the country (Damodar *et al.*, 2005). Under the name of rapeseed-mustard, seven important annual oilseeds belonging to the Brassicaceae (Cruciferae) are grown in India. They are Indian mustard or raya [*Brassica juncea* (L.) Czern. & Coss.]; the three ecotypes of *B. campestris* L. viz., toria, brown sarson and yellow sarson; gobhi sarson (*B. napus* L.), Ethiopian mustard (*B. carinata* Braun.) and taramira (*Eruca sativa* Mill.). Rapeseed-mustard is grown for the production of animal feed, vegetable oil for human consumption and biodiesel. Natural rapeseed oil contains 50% erucic acid and also contain high levels of glucosinolates (Pahariya *et al.*, 2007). Canola is rapeseed/mustard seed with low erucic acid and glucosinolate and it is safe for consumption of human and livestock (Dupont *et al.*, 1989). It also

contains adequate amounts of the two essential fatty acids, linoleic and linolenic, which are not present in many of the other edible oils. *B. juncea* is the dominant species grown and along with *B. rapa* (syn. *B. campestris* L.) and *B. napus* L. in Indian subcontinent and are the important sources of edible oil in India.

#### Area, production and yield of major crop growing States.

(Average of 2006-07 to 2010-11)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Rapeseed-Mustard	Rajasthan	27.650	32.318	1169
	Uttar Pradesh	7.203	8.228	1142
	Haryana	5.132	8.062	1571
	Madhya Pradesh	7.224	7.694	1065
	West Bengal	4.121	3.841	932
	Gujarat	2.556	3.804	1488
<b>Total Rapeseed-mustard</b>		<b>61.012</b>	<b>68.850</b>	<b>1128</b>

\*source: (DOD, GOI, Hyderabad, 2014).

Rajasthan, Uttar Pradesh, Haryana and Madhya Pradesh are the major rapeseed-mustard growing States contributing about 77% and 82% of the total rapeseed-mustard area and production of the country.

#### Area, production and yield of major crop growing countries.

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Rapeseed-Mustard	China	68.695	125.854	1832
	Canada	68.272	123.622	1811
	India	61.012	68.850	1128
	Germany	14.429	52.764	3657
	France	15.117	50.450	3337
<b>Total Rapeseed-mustard (World)</b>		<b>322.295</b>	<b>593.162</b>	<b>1840</b>

\*source: (DOD, GOI, Hyderabad, 2014).

India ranks third in respect of area coverage and production of rapeseed-mustard after China and Canada. However, the productivity is low compared to all major countries cultivating rapeseed-mustard.

#### Sunflower

The cultivated sunflower (*Helianthus annuus* L.) is native of southern United States and Mexico, during later part of 20<sup>th</sup> century, the crop was introduced to India. Seed contains the oil varying from 35-43%. The unsaturated fatty acids such as oleic and linoleic, comprise about 90% of the total.

#### Area, production and yield of major crop growing States

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Sunflower	Karnataka	7.222	3.670	508
	Andhra Pradesh	3.156	2.626	832
	Maharashtra	2.168	1.304	601
	Tamil Nadu	0.213	0.316	1484
	<b>Total sunflower</b>		<b>13.724</b>	<b>9.279</b>

\*source: (DOD, GOI, Hyderabad, 2014).

Karnataka, Andhra Pradesh and Maharashtra are the major sunflower growing states contributing about 91% and 82% of the countries area and production, respectively.

#### Area, production and yield of major crop growing countries

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Sunflower	Russian Federation	58.754	69.036	1175
	Ukraine	42.253	65.006	1539
	Argentina	19.958	33.048	1656
	China	9.164	16.688	1821
	France	6.616	16.270	2459
	India	13.724	9.279	676
	<b>Total sunflower (world)</b>		<b>238.778</b>	<b>332.089</b>

\*source: (DOD, GOI, Hyderabad, 2014).

India ranks fourth in area coverage of sunflower, but the production-wise it ranks 8<sup>th</sup> due to very low productivity compared to other countries.

#### Sesamum

Sesame (*Sesamum indicum* L.) is the oldest known

oil plant cultivated by man and native of India. 70-75% of production used for oil extraction. Sesame contains 50% oil, 25% protein and 15% carbohydrates. Oil contains about 40% oleic and 40% linoleic acid. Sesame is drought-tolerant and is able to grow where other crops fail (Ram *et al.*, 1990).

### Area, production and yield of major crop growing States

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Sesamum	Rajasthan	4.988	1.532	307
	Uttar Pradesh	3.072	0.517	168
	Gujarat	2.599	1.100	423
	Madhya Pradesh	2.458	1.120	456
	West Bengal	1.914	1.617	845
<b>Total sesamum</b>		<b>19.070</b>	<b>7.378</b>	<b>387</b>

\*source: (DOD, GOI, Hyderabad, 2014 ).

### Area, production and yield of major crop growing countries

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Sesamum	Myanmar	15.167	8.433	556
	India	19.070	7.378	387
	China	4.797	5.921	1234
	Sudan	12.774	2.895	227
	Uganda	2.842	1.724	607
<b>Total sesamum (world)</b>		<b>74.058</b>	<b>39.592</b>	<b>535</b>

\*source: (DOD, GOI, Hyderabad, 2014 ).

India ranks second in sesame production even though the area under sesame is highest in India. The world harvested about 3.84 million metric tonnes of sesame seeds in 2010 and the largest producer of sesame seeds in 2010 was Myanmar (FAO, 2012). The world's largest exporter of sesame seeds was India and Japan the largest importer.

### Castor

The castor (*Ricinus communis* L.) is a perennial shrub that originated in Africa, but now cultivated in many tropical and subtropical regions around the world. It can

be self- and cross-pollinated and worldwide studies reveal low genetic diversity among castor bean germplasm (Foster, 2010 and Ramos *et al.*, 1984). Oil content of the seed varies from 35-58%. Approximately 90% of the oil from castor bean seeds is composed of the unusual hydroxylated fatty acid, ricinoleic acid (Nde *et al.*, 2006). Ricinoleic acid confers unique chemical properties to the oil, because of that, it is a highly valued oilseed crop for lubricant, cosmetic, medical and specialty chemical applications. Castor bean has also been proposed as a potential source of biodiesel (Scarpa *et al.*, 1982). Percentage share in production in India-4.01%. In India, castor is cultivated in 16 States. India is ranks first in production and productivity.

### Area, production and yield of major crop growing States

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Castor	Gujarat	5.164	10.360	2006
	Rajasthan	1.607	2.087	1299
	Andhra Pradesh	1.896	0.894	472
	Chattisgarh	0.454	0.210	463
<b>Total castor</b>		<b>9.478</b>	<b>13.758</b>	<b>1451</b>

\*source: (DOD, GOI, Hyderabad, 2014 ).

Gujarat, Rajasthan and Andhra Pradesh are the major castor growing states contributing about 91% and 97% to the countries area and production, respectively.

### Area, production and yield of major crop growing countries

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Castor	India	9.478	13.758	1451
	China	2.100	1.780	848
	Brazil	1.681	1.053	627
	Thailand	0.108	0.125	1157
	Paraguay	0.131	0.115	876
<b>Total castor (world)</b>		<b>15.738</b>	<b>17.937</b>	<b>1140</b>

\*source: (DOD, GOI, Hyderabad, 2014 ).

### Safflower

Safflower (*Carthamus tinctorius* L) was believed

to be originated in an area bounded by the eastern Mediterranean and Persian Gulf. Seeds contain 28-32% oil. Share of India in production is 0.6%. Oil rich in polyunsaturated fatty acids (linoleic acid 78%), which play an important role on reducing blood cholesterol level. Productivity are influenced by many factors like genotype, environment and agronomic practices (Spyridon *et al.*, 2006). Safflower in India is cultivated by 10 States over an area of 2.79 lakh ha.

#### Area, production and yield of major crop growing States

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Safflower	Maharashtra	1.802	1.058	587
	Karnataka	0.642	0.492	766
	Gujarat	0.307	0.217	707
	Andhra Pradesh	0.132	0.080	606
<b>Total safflower</b>		<b>2.794</b>	<b>1.777</b>	<b>636</b>

\*source: (DOD, GOI, Hyderabad, 2014).

Maharashtra and Karnataka are major safflower growing States contributing about 87% of total India's area and production of safflower.

#### Area, production and yield of major crop growing countries

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Safflower	India	2.794	1.777	636
	USA	0.669	1.047	1564
	Mexico	0.740	1.029	1390
	Kazakhstan	1.145	0.756	660
	Argentina	0.721	0.557	772
<b>Total safflower (world)</b>		<b>7.298</b>	<b>6.272</b>	<b>859</b>

\*source: (DOD, GOI, Hyderabad, 2014).

India ranks first in respect of area and production of safflower, however, the productivity is low compared to other countries.

#### Niger

Niger seed (*Guizotia abyssinica*) is underutilized oilseed crop, which is commonly known as *ramtil* or *kala*

*til*. Total lipid content of niger is 49.9% of seed weight. The major fatty acid in niger is linoleic acid followed by oleic acid and the major saturated fatty acid is palmitic acid followed by stearic acid (Ramdan *et al.*, 2003). Niger (*Guizotia abyssinica*) is important in terms of 34-36% of quality oil with 18-20% protein in the seed and oil has good keeping quality and has 70% unsaturated fatty acids free from toxins. India ranks first in area, production & export of niger in the world.

#### Area, production and yield of major crop growing States.

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Niger	Madhya Pradesh	1.144	0.242	212
	Odisha	0.980	0.354	362
	Chhattisgarh	0.702	0.121	173
	Maharashtra	0.308	0.100	263
	Karnataka	0.252	0.076	302
	<b>Total niger</b>		<b>3.824</b>	<b>1.064</b>

\*source: (DOD, GOI, Hyderabad, 2014).

Madhya Pradesh, Odisha, Chhattisgarh, Maharashtra and Karnataka are the major State growing niger.

#### Linseed

Linseed (*Linum usitatissimum* L.) belongs to the genus *Linum* of the family *Linaceae*. It is the sixth largest oilseed crop of the world (Singh *et al.*, 2013). It is cultivated for the main products *viz.*, fibre (flax fibre) and seed oil (linseed) or both (dual purpose linseed). Linseed in India mostly utilized for extraction of oil. It is a self pollinated crop although less than 2% natural out-crossing has been reported (Dillman, 1928). Flax seeds come in two basic varieties: 1. brown; and 2. yellow or golden (also known as golden linseeds). Recently it has gained a new interest in the emerging market of functional food due to its high content of fatty acids, alpha linolenic acid (ALA), an essential Omega-3 fatty acid and lignin oligomers which constitute about 57% of total fatty acids in linseed (Pali *et al.*, 2014). Oil content in linseed ranges from 33-45% with protein content 24% (Gill, 1987). Linseed in India is cultivated by 17 states over an area of 3.80 lakh ha.

#### Area, production and yield of major crop growing States

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major States	Area	Production	Yield
Linseed	Madhya Pradesh	1.186	0.463	390
	Uttar Pradesh	0.633	0.241	382
	Chhattisgarh	0.451	0.136	301
	Maharashtra	0.424	0.108	255
	Bihar	0.250	0.214	858
<b>Total linseed</b>		<b>3.799</b>	<b>1.571</b>	<b>413</b>

\*source: (DOD, GOI, Hyderabad, 2014).

The major states cultivating linseed are Madhya Pradesh and Uttar Pradesh followed by Chhattisgarh and Maharashtra.

### Area, production and yield of major crop growing countries

(Average of 2007-08 to 2011-12)\*

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

Crop	Major countries	Area	Production	Yield
Linseed	Canada	4.798	6.432	1341
	China	3.409	3.252	954
	USA	1.290	1.569	1216
	India	3.799	1.571	413
	Ethiopia	1.823	1.367	750
<b>Total linseed (world)</b>		<b>21.275</b>	<b>18.667</b>	<b>877</b>

\*source: (DOD, GOI, Hyderabad, 2014).

India ranks fourth among the major linseed cultivating states, however, the production is less compared to other countries due to lower productivity.

## References

Damodaran, T. and D. M. Hegde (2005). "Oilseeds Situation : A Statistical Compendium 2005," *Directorate Oilseeds Research*, Indian Council of Agricultural Research, Hyderabad.

Da Silva Nde, L., M. R. Maciel, C. B. Batistella and Maciel R. Filho (2006). Optimization of biodiesel production from castor oil. *Appl. Biochem. Biotechnol.*, **130** : 405-414.

Da Silva Ramos, L. C., J. Shogiro Tango, A. Savi and N. R. Leal (1984). Variability for oil and fatty acid composition in castorbean varieties. *J. Am. Oil Chem. Soc.*, **61** : 1841-1843.

Dilman, A. C. (1928). Daily growth and oil content of flaxseeds. *Journal of Agricultural Research*, **37** : 357-377.

Dupont, J., P. J. White, H. A. Johnston, B. E. McDonald, S. M. Grundy and A. Bonanome (1989). Food safety and health effects of canola oil. *Journal of the American College of Nutrition*, **8(5)** : 360-375.

Dwivedi, S. L. and J. H. Crouch (2003). Proceedings of a workshop for the Asian Development Bank supported project on molecular breeding of sorghum, groundnut and chickpea. *ICRISAT* : 28-43.

FAOSTAT (2011). <http://faostat.fao.org/site/567/default.aspx>. Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization of the United Nations (2012). *Production Crops : sesame seeds*.

Foster, J. T. *et al.* (2010). Single nucleotide polymorphisms for assessing genetic diversity in castor bean (*Ricinus communis*). *BMC Plant Biology*, **10** : 13.

Gill, K. S. (1987). *Linseed*. Indian Council of Agricultural Research, New Delhi.

Pahariya, N. C. and Chandan Mukherjee (2007). Commodity Revenue Management : India's rapeseed/mustard oil sector. CUTS International.

Pali, Vikas and Nandan Mehta (2014). Estimation of heterosis for seed yield and its attributing traits in linseed (*Linum usitatissimum* L.). *Electronic Journal of Plant Breeding*, **5(1)** : 120-123.

Ram, R., D. Catlin, J. Romero and C. Cowley (1990). Sesame : New approaches for crop improvement. *Advances in New Crops* : 225-228.

Ramadan, Mohamed Fawzy and Morsel Thomas (2003). Phospholipid composition of niger (*Guizotia abyssinica* cass.) seed oil. *LWT - Food Science and Technology*, **36(2)** : 273-276.

Savage, G. P. and J. I. Keenan (1994). The composition and nutritive value of groundnut kernels. In : *The groundnut crop : A scientific basis for improvement*. Edited by Smart J. London, UK: Chapman and Hall : 173-213.

Scarpa, A. and A. Guerci (1982). Various uses of the castor oil plant (*Ricinus communis* L.). A review. *J. Ethnopharmacol.*, **5** : 117-137.

Singh, R. P. (2014). *Status paper on oilseed crops*, Directorate of Oilseeds Development Government of India, Ministry Of Agriculture, Hyderabad.

Singh, R. K., Aarti Singh and Kanchan Singh (2014). Effect of moisture conservation practices on linseed (*Linum usitatissimum* L.). *Environment and Ecology*, **32(2)** : 425-427.

Spyridon, D., Koutroubas, Despo K. Papakosta and Alexandros Doitsinis (2006). Phenotypic variation in physiological determinants of yield in spring sown safflower under Mediterranean conditions. *Field Crops Research*, **112(2)** : 199-204.

Sonnad, J. S., N. Raveendranl, N. Ajjanl and K.N. Selvaraj (2011). Growth analysis of oilseed crops in India during

- pre and post - WTO periods. *Karnataka J. Agric. Sci.*, **24(2)**: 184-187.
- Stalker, H. T. and J. P. Moss (1987). Speciation, cytogenetics and utilization of *Arachis* species. *Adv Agron*, **41** : 1-39.
- Upadhyaya, Hari D., Bramel Rodomiro Ortiz, J. Paula and Sube Singh (2003). Development of a groundnut core collection using taxonomical, geographical and morphological descriptors. *Genetic Resources and Crop Evolution*, **50(2)** : 139-148.
- Weiss, E. A. (1983). *Oilseed Crops*. London, UK: Longman; 1983:660.