

Model Training course on  
“Good Management Practices for Increasing Profitability  
and  
Resource Use Efficiency in Oilseed Crops”

27 October to 3 November, 2015



**Course Director**  
**M.Padmaiah**

**Course Conveners**  
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**ICAR-Indian Institute of Oilseeds Research**  
**Rajendranagar, Hyderabad - 500 030**



**Model Training Course**  
**On**  
**GOOD MANAGEMENT PRACTICES FOR INCREASING**  
**PROFITABILITY AND RESOURCE USE EFFICIENCY IN OILSEED**  
**CROPS (27 October to 3 November, 2015)**

**Sponsored by**  
**Directorate of Extension**  
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## Oilseeds for better health

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The lipids are a large and diverse group of naturally occurring organic compounds that are related by their solubility in nonpolar organic solvents (e.g. ether, chloroform, acetone & benzene) and general insolubility in water. Oils and fats are the major component of lipids. Chemically lipids are fatty acids and their derivatives, and substances related biosynthetically or functionally to these compounds. Major source of lipids is vegetable oils. Fats are solid or semi-solid at room temperature while oils are liquid at room temperature. Apart from the traditional convention of grouping fatty acids based only on the number of double bonds, i.e. saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), individual fatty acids within each broad classification of fatty acids may have unique biological properties and health effects (Burlingame, 2009).

Total fat intake should be greater than 15%E to ensure an adequate intake of essential fatty acids and energy and to facilitate the absorption of lipid soluble vitamins (Jequier, 1999). While for most individuals engaged in moderate physical activity 30%E is recommended, for those associated with a high physical activity level it can amount to 35%E. There is convincing evidence that replacing SFA with PUFA decreases the risk of CHD. There is probable evidence that replacing SFA with largely refined carbohydrates has no benefit on CHD, and may even increase the risk of CHD and favour metabolic syndrome development. (Jakobsen et al., 2009).

It is recommended that SFA should be replaced with PUFA (n-3 and n-6) in the diet and the total intake of SFA should not exceed 10%E (Elmadfa and Kornsteiner, 2009). Evidence are there that LA and ALA are indispensable since they cannot be synthesized by humans. The recommended range for PUFA is 6–11%E. For adult males and non-pregnant/non-lactating adult females 0.250 g/day of EPA plus DHA is recommended. The US Food and Drug Administration (DHHS 1997) having set a 'Generally Regarded as Safe' level of 3000 mg/day for n-3 LCPUFA. Individual saturated fatty acids (SFA) have different effects on the concentration of plasma lipoprotein cholesterol fractions. For example, lauric (C12:0), myristic (C14:0) and palmitic acids (C16:0) increase LDL cholesterol whereas stearic has no effect. Vegetable oils do not contain cholesterol. Animal fats, coconut oil and palm oil are full of saturated fatty acids. It is known that saturated fatty acids accelerate the metabolism of cholesterol. Human body cannot synthesize polyunsaturated fatty acids (PUFA). PUFAs are essential fatty acids and we have to supply to body. (n-3) Fatty acids like Docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) play important role as nutraceuticals. DHA is the primary structural lipid in human brain tissue and is poorly synthesized by infants. Babies need DHA when their brains are developing and primary source of DHA for infants is breast milk.

Table 1: Dietary recommendation of total fats/FA (According to FAO guidelines)

Fat/FA	Age group	Numeric amount E% (energy percent)
Total fat	0-6 months	40-60

	6-24 months	35
	2-18	25-35
	Adult	30
SFA	0-6 months	
	6-24 months	
	2-18	8
	Adult	10
PUFA	0-6 months	total fat [%E] - SFA [%E] - PUFA [%E] - TFA [%E]
	6-24 months	
	2-18	
	Adult	
Total PUFA	0-6 months	
	6-24 months	<15
	2-18	11
	Adult	6-11
AA	0-6 months	0.2-0.3
LA	0-6 months	
	6-24 months	3-4.5
	2-18	3-4.5
	Adult	2.5-3.5
n-3 PUFA		
ALA	0-6 months	0.2-0.3
	6-24 months	0.4-0.6
	2-18	0.5-2
	Adult	0.5-2
DHA	0-6 months	0.1-0.18
	6-24 months	10-12mg/kg
EPA+DHA	2-4 yrs	100-150mg
	4-6 yrs	150-200mg
	6-10yrs	200-250 mg
	2-18	0.250-2
	Adult	0.250-2
TFA	For all age group	<1

E- energy; SFA- saturated fatty acids; MUFA -monounsaturated fatty acids; PUFA- polyunsaturated fatty acids; TFA- trans-fatty acids; LA -linoleic acid; ALA -alpha-linolenic acid; EPA-eicosapentaenoic acid; DHA- docosahexaenoic acid; AA- arachidonic acid.

Oils & Fats have caloric and nutritional value and increase palatability of food, enhance flavor and modify the texture of foods, delays digestion, impart the feeling of satiety, associated with the fat-soluble vitamins A, D, E and K, and the absorption of these vitamins is impaired at very low fat intakes. Fats and oils are mostly used for salad dressing and cooking includes coconut, corn, cottonseed, olive. Palm, groundnut, sunflower, safflower, sesame, rice bran and mustard etc. If a normal adult person consumes 2000 calories each day, no more than 600 calories should come



from fat. 1g of fat provides 9 calories hence, daily intake of fat should be less than 66g. Likewise we can calculate proportion intake of different fatty acids.

Meals high in fat result in postprandial lipaemia (rise in triglyceride-rich lipoproteins after eating). Elevated postprandial lipid concentrations are associated with progression of atherosclerosis and increased risk of thrombosis. Diets containing a higher proportion of carbohydrate in place of fat result in an increase in plasma TG concentrations in the fasting state, but lower plasma TG concentration in the postprandial state (Mensink et al., 2003). Animal studies indicate that diets rich in saturated fatty acids impair insulin sensitivity and that n-3 LCPUFA improve insulin sensitivity.

Table 2 : Calories requirement for different age groups

	Age (years)	Sedentary <sup>b</sup>	Moderately Active <sup>c</sup>	Active <sup>d</sup>	
Child	2-3	1,000	1,000-1,400	1,000-1,400	
	Female	4-8	1,200	1,400-1,600	1,400-1,800
		9-13	1,600	1,600-2,000	1,800-2,200
		14-18	1,800	2,000	2,400
		19-30	2,000	2,000-2,200	2,400
Male	31-50	1,800	2,000	2,200	
	51+	1,600	1,800	2,000-2,200	
	4-8	1,400	1,400-1,600	1,600-2,000	
	9-13	1,800	1,800-2,200	2,000-2,600	
	14-18	2,200	2,400-2,800	2,800-3,200	
	19-30	2,400	2,600-2,800	3,000	
	31-50	2,200	2,400-2,600	2,800-3,000	
	51+	2,000	2,200-2,400	2,400-2,800	

<sup>a</sup> These levels are based on Estimated Energy Requirements (EER) from the Institute of Medicine Dietary Reference Intakes macronutrients report, 2002, calculated by gender, age, and activity level for reference-sized individuals. "Reference size," as determined by IOM, is based on median height and weight for ages up to age 18 years of age and median height and weight for that height to give a BMI of 21.5 for adult females and 22.5 for adult males.

<sup>b</sup> Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life.

<sup>c</sup> Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life

<sup>d</sup> Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

#### Oilseeds and their properties

##### Soyabean

It is most popular and largest growing oilseed crop in the world. Soybean possesses very high nutritional value, contains 20 % oil and 50 % high quality protein. The protein of soybean is 2 times richer than pulses, 3 times richer than eggs and 11 times richer than milk. Protein is rich

in valuable amino acid Lysine (5%) and deficient in cereals. Soya foods are rich source of vitamins like A, B, C and contain essential minerals like magnesium, calcium, iron, potassium and copper. Soybeans are industrially used for production of antibiotics.

#### **Groundnut**

Groundnut is the single largest source of edible oil in India. Almost every portion of groundnut is of commercial value. Other than as edible oil used in cooking preparations it can be used in industrially for soap making, fuels, cosmetics, shaving cream, leather dressings, furniture cream, lubricants, etc. in fact, it plays a pivotal role for table purpose and oilseed economy of India.

#### **Rapeseed and Mustard**

Mustard oil is used in making pickles, for frying and flavouring vegetables. Oil is rich in medicinal properties used as a cure for arthritis, lumbago and rheumatism. Rapeseed-Mustard meal is a good source of protein for livestock and poultry. It is accepted as a healthy cooking medium because of low saturated fatty acids (8%), high mono saturated fatty acids (70%) and alpha linolenic acid (10%). Mustard seeds have been highly prized medicinal as well as culinary spice being in use since earlier times. It contains the lowest amount of fatty acids and high amounts of monounsaturated and polyunsaturated fatty acids, which are good for health. It has the ideal ratio of omega-3 and omega 6 fatty acids, a high content of antioxidants and vitamin E, niacin (vitamin B-3), B-complex vitamins.

#### **Sesame**

Sesame seeds are rich in proteins, fats, carbohydrates, fibers and other minerals and vitamins. The seeds have high oil content around 55%. It is generally used as oil, as flavouring agent in numerous cuisines, in baking candy making and has high nutritive value due to presence of antioxidants. Sesame oil is used in cooking and in preparation of salads and also finds its use in the production of margarine, soaps, pharmaceuticals, paints, insecticides and lubricants. Sesame oil is markedly different from all other vegetable oils due to its high nutritional and therapeutic values besides being highly stable to oxidation and is widely utilized in tropical and sub-tropical regions. Sesame oil is stable and do not became stale because of the presence of sesamin, sesamol, sesaminol, sesamol,  $\gamma$ -tocopherol.

#### **Sunflower**

Sunflower oil contains more Vitamin E than any other vegetable oil and hence, it is very much is used in food products. Sunflower oil is used as a frying medium and as an emollient in cosmetic formulations. Sunflower oil also contains Lecithin, Tocopherols, Carotenoids and Waxes.

#### **Niger**

Niger gives good cooking oil with nutty taste and pleasant odour and also be used in cosmetics, perfume industry and for lubrication. Niger contains 85% poly unsaturated fatty acid mostly comprising of linoleic, oleic acid and also omega 3 & 6. Hence it is good edible oil.

#### **Safflower**

Use of safflower oil as cooking medium is increasing as it is the richest source of Linoleic acid an essential fatty acid. The seeds are edible and are eaten after roasting. Safflower petals are mostly used as red and yellow color dyes for clothing and in food preparation as a substitute for saffron in the markets of Middle East and are used to color foods and beverages. The petals are



also used in preparation of herbal tea in India. The stalks can be used for preparation of particle board. Their oil content varies from 24 to 36 per cent. The cold pressed oil is golden yellow and is used for culinary purposes, or for making soap.

### Linseed

Linseed (*Linum usitatissimum*) is highly valued for its nutraceutical properties, fibre and is the most abundant source of  $\alpha$ -linolenic acid.  $\alpha$ -linolenic acid which is the precursor of docosahexaenoic acid, structural material for nervous tissue, including the brain. Linseed fibers are taken from the stem of the plant and are two to three times as strong as those of cotton. Linseed also contain small amounts of phytonutrients called lignans. Lignans are fiber-like compounds, but they also have very high antioxidant capacity due to their structure as polyphenols.

The Indian Council of Medical Research (ICMR) and American Heart Association (AHA) recommended that best possible health benefits can be attained by consuming equal proportions of SFA, MUFA and PUFA (Table 3). The above said composition is not accessible from any single fat/oil found from natural sources. The characteristics of any fat/oil can be modify through blending, fractionation, hydrogenation or combinations of these processes offers greater functionality to food and allied industries.

Table 3: Recommendation of fatty acids in diet

S		MU		PUFA					
1	:	1	:	1	33.3	:	33.3	:	33.3 (American Heart Assn.)
1	:	1.5	:	1	28.5	:	43	:	28.5 (Japan's Ministry of Health & Welfare)
1	:	1.5	:	0.7	31	:	48	:	21 (WHO)

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