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Lipid and Fatty Acid Changes During Seed Development of Safflower (*Carthamus tinctorius* L.) Var. Bhima

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A field experiment was conducted during *rabi* season of 1995-96 at the College Agronomy Farm, Gujarat Agricultural University, Anand, to find out effect of different maturity stages S_1, S_2 and S_3 (15, 30 and 45 DAF), on lipid content and fatty acid profile of safflower seed. Lipid content on both fresh and dry weight basis increased from S_1 to S_3 stages of seed maturity. Among different fatty acids, palmitic acid was significantly decreased, while oleic acid and linoleic acids were significantly increased with advancement of maturity. At 45 DAF linoleic acid was found to be maximum (68.6%).

Recommended dose of fertilizers (50:25:0, N:P:K kg ha^{-1}) was given prior to sowing. Cultural practices were done as per the package of practices recommended for safflower cultivation. In the later stage of crop growth, sucking pest (aphids) was controlled through spraying of Malathion 30 EC @ 0.3 ml L^{-1} water. To control alternaria leaf spot, Mancozeb 0.25 % was sprayed @ 0.5 g L^{-1} water.

Developing seeds were harvested at different days after flowering (DAF) viz., (15 DAF S_1), (30 DAF S_2) and (45 DAF S_3).

Observations on fresh and dry weight of seeds were recorded and moisture content was worked out. Dry seeds were analyzed for total lipid (Baxi, 1989) and fatty acid composition of total lipid was determined by Gas Liquid Chromatography (GLC) after methylation with sodium methoxide and boron trifluoride (BF3) (Morrison & Smith, 1964). The laboratory analytical data of replicated samples were subjected to statistical analysis of variance (Snedecor *et al.*, 1967).

The data obtained for the moisture, total lipid (fresh and dry weight basis) and changes in fatty acid on per cent weight basis as well as g per total lipid basis at different maturity stages are presented in Table-1.

Total Lipid

The accumulation of lipids in safflower seed in general was accompanied by decrease in moisture content due to methods. But the increase in lipid content from S_1 to S_2 stage, was much faster than the fall in seed moisture content between these stage of seed maturity. This is because of the fact that lipid is not the only material being stored during seed development. These changes of total lipid

TABLE 1

Lipid and fatty acid profile during seed development of safflower.

Seed development stages	*Moisture content (%)*	*Total lipid (%)*		*Fatty acid composition**					
				Per cent weight basis			*g/total lipid basis*		
		Fresh	*Dry*	*Palmitic acid*	*Oleic acid*	*Linoleic acid*	*Palmitic acid*	*Oleic acid*	*Linoleic acid*
S_1 (15 DAF)	64.31	3.63	10.14	31.84	14.63	53.49	3.18	1.45	5.30
S_2 (30 DAF)	28.03	17.03	23.66	20.91	16.14	62.95	4.93	3.82	14.82
S_3 (45 DAF)	5.48	32.04	33.90	11.44	19.76	68.80	3.87	6.69	23.31
S. Em.	0.181	0.054	0.086	0.111	0.111	0.132	0.034	0.026	0.070
C.D. (0.05)	0.511	0.153	0.243	0.317	0.317	0.377	0.099	0.076	0.199

* Average of two replications.

content are in agreement with those reported by Ichihara and Noda (1980) for safflower.

Fatty Acid Profile

Palmitic acid content was significantly affected due to stages of maturity. Among maturity stages, S_1 recorded significantly the highest palmitic acid content, which decreased significantly as the maturity advanced. Such decrease in palmitic acid was also reported by Ichihara and Noda (1980) in safflower during seed development. Similar decrease in palmitic acid was also reported in sunflower (Hazel *et al.*, 1978; Lotti *et al.*, 1987 and Rana *et al.*, 1990), mustard (Mukherjee and Kiewitt, 1984; Zukelova *et al.*, 1985), soyabean (Rubel *et al.*, 1972) and groundnut (Sander, 1980 and William *et al.*, 1984).

The percentage of oleic acid ($C_{18:1}$) was less (14.63%) at S_1 maturity stage, which significantly increased at each successive stages of maturity i.e. from S_1 to S_2 and S_2 to S_3 stage (Table-1). The increase in oleic acid percentage was accompanied by the decrease in palmitic acid during seed development. The increase in oleic acid coincided with the increase in synthesis of TG as seed progressed towards maturity. This type of change in oleic acid percentage has also been reported in safflower by Ichihara and Noda (1980). Similar increase in oleic acid was also reported in sunflower (Rana *et al.*, 1990), mustard (Awasthi and Pathak, 1993) and groundnut (Niranjan Kumar *et al.*, 1988).

The percentage of linoleic acid ($C_{18:2}$) (Table-1) was less at S_1 maturity stage but continuously increased in subsequent stages of maturity. The increase in linoleic acid content with maturity may be due to increase in the activity of oleooyl desaturase and decrease in palmitic acid content during seed development. Ichihara and Noda (1980) reported that $C_{18:2}$ and $C_{18:1}$ were complementary to each other in proportion.

Oleic acid and linoleic acid on g per total lipid basis continuously increased with the advancement of seed maturity, whereas palmitic acid increased upto S_2 maturity stage and thereafter it decreased at S_3 stage. The increase in amount of fatty acids is only due to accumulation of more lipid with progressive maturity but the proportional fall in palmitic percentage could not be accompanied by the percentage rise in lipid content after 30 DAF to seed maturity (45 DAF).

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REFERENCES

*Awasthi, P. K. and Pathak, R. K. (1993). Changes in oil content and fatty acid composition in develop seeds of high erucic mustard varieties. *Agrochimica*, **37** : 77-85. [Fide : *Field Crop Abstract*, **47** (10) : 6698, 1994].

Baxi, H. C. (1989). Changes in lipid classes and fatty acid composition during development in groundnut (*Arachis hypogaea* L.) seed. M.Sc. (Agri.) thesis submitted to B. A. College of Agriculture, GAU, Anand.

Hazel, C. H.; Mc William, J. R. and Mason, W. K. (1978). Influence of temperature on oil content and composition of sunflower seed. *Aust. J. Agric. Res.*, **29** : 1203-1212.

Ichihara, K. and Noda, M. (1980). Fatty acid composition and lipid synthesis in developing safflower seeds. *Phytochemistry*, **19** : 49-54.

*Lotti, G.; Navari-Izzo, F.; Izzo, R. and Quartacci, M. S. (1987). Fatty acids and phospholipids in the early stages of seed formation in sunflowers. *Agrochimica,* **31** : 275-286. [Fide : *Field Crop Abstr.*, **41** (6) : 4093, 1988].

Mc rrison, W. R. and Smith, L. M. (1964). Preparation of methyl esters. *J. Lipid Res.*, **5** : 600.

Mukherjee, K. D. and Kiewitt, I. (1984). Changes in fatty acid composition of lipid classes in developing mustard seed. *Phytochemistry,* **23** : 349-352.

Niranjankumar, Srivastava, K. N.; Sharma, N. D. and Mehta, S. L. (1988). Oil synthesis and composition in developing cotyledons of groundnut. *J. Nuclear Agric. Biol.*, **17** : 11-17.

Rana, M. A.; Ozair, C. A.; Khan, M. A. and Shafiullah (1990). Effect of maturity stages and desiccant application on seed yield and oil quality of sunflower. *Crop Res. (Hissar),* **3** : 40-50.

Rubel, A.; Rinne, R. W. and Canvin, D. T. (1972). Protein, oil and fatty acid in developing soybean seeds. *Crop Sci.*, **12** : 739-741.

Sanders, T. H. (1980). Effects of variety and maturity on lipid class composition of peanut oil. *J. Amer. Oil Chem. Soc.*, **57** : 8.

Snedecor, G. W. and Cochran, W. G. (1967). Statistical methods, 6th Ed. Oxford and IBH Publishing Co., Calcutta.

William, A. C.; Roy, R. C. and Hendel, J. G. (1984). Effect of harvest date on argonomic and chemical characteristics of Ontario peanuts. *Can. J. Pl. Sci.* **64** : 521.

*Zukalova, H.; Vasak, J. and Fabry, A. (1985). Changes in the quality characteristics of winter rape cultivars free from erucic acid and glucosinolates. *Rostlinna Vyroba,* **31** : 685-692. [Fide : *Field Crop Abstract,* **41** (2) : 1419, 1988].