Technical

Variations in Oil Content and Fatty Acid Composition with Sunflower Head Size and Shape

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ABSTRACT

Medium (8" dia.) and small (4") sized sunflower (EC 68415) heads of convex shape yielded seeds with more oil (>44%), unsaturation (I.V.>120) and linoleic acid (>48%) compared to big (12") sized flower heads of convex shape (42%, 100.7, 27.3%, respectively). Both convex and flat shaped flower heads of medium size yielded seeds with more oil (>45%), unsaturation (I.V.>120) and linoleic acid (>48%) than did the concave shaped flower heads of medium size (39.9%, I.V. 112.6, 39.3%, respectively). The oil content, degree of unsaturation and linoleic acid content were thus found to vary with the size and shape of the sunflower head.

INTRODUCTION

Position of seed in the sunflower head is known to influence the oil content and fatty acid composition of oil (1,2). Seeds from inner zone have been reported to contain less oil compared to middle and outer zones, indicating lesser extent of pollination of the inner zone. Linoleic and palmitic acids increased and oleic acid decreased from perimeter towards the center of the flower head (3). In the present work, variations in the oil content and composition with the size and shape of the flower head have been investigated.

MATERIALS AND METHODS

Samples of seeds from sunflower heads, belonging to a single variety EC 68415 of different sizes (dia. 12", 8", and 4") and shapes (convex, flat and concave) were obtained from plants grown at Hayatnagar Research Farm (ICAR), Hyderabad with adequate water availability. All planting was done on the same day. Flowering occurred on the 56th day after planting, and the mature seeds were harvested on the 98th day. Seeds from all parts of 40 flower heads for each type of size and shape were combined, thoroughly mixed, and samples for analyses (ca. 10 g) were prepared by quartering. Average daily temperature from flowering to harvesting varied from 25.7 to 28.4 C.

Oil content was determined by extraction with petroleum ether (b.p. 40–60 C) in a Soxhlet. Fatty acid methyl esters were prepared according to the method of Luddy et al. (4). Fatty acid composition was determined using a F & M-720 gas chromatograph equipped with a hydrogen flame ionization detector. A stainless steel column (6' x 3/16") packed with 15% DEGA on Chromosorb P (45–60 mesh) and maintained at 195 C was used. Nitrogen flow rate was 30 ml/min.

RESULTS AND DISCUSSION

The data in Table I show that both oil content of sunflower seeds and fatty acid composition of the oil vary with the size of flower head. Oil content, iodine value and linoleic to oleic ratio were much higher for seeds from small and medium sized flower heads compared to those from big sized flower heads. The data also show that oil content, iodine value and linoleic to oleic ratio were considerably higher for seeds from convex and flat shaped flower heads than those from concave shaped flower heads. Since all the seed samples were produced and prepared under the same conditions, the observed variations, therefore, were not due to differences in variety, planting, flowering and harvesting dates, temperature, water availability and position of the seeds in the flower heads. Thus, a relationship between the oil content and fatty acid composition and the sunflower head size and shape is indicated. Further studies on a larger

TABLE I

Variations in Oil Content and Fatty Acid Composition with Sunflower Head Size and Shape

Sunflower head size and shape	Oil[a]%	I.V. (calc.)	Fatty acid composition (wt. %) 16:0	18:0	18:1	18:2	18:2÷ 18:1
Size[b]							
Small (4" dia.)	44.5	121.0	7.0	4.2	37.4	51.3	1.37
Medium (8" dia.)	45.2	120.6	6.1	2.4	43.4	48.1	1.11
Big (12" dia.)	42.0	100.7	6.0	4.6	62.1	27.3	0.44
Shape[c]							
Convex	45.2	120.6	6.1	2.4	43.4	48.1	1.11
Flat	45.0	124.3	6.0	2.5	38.9	52.5	1.35
Concave	39.9	112.6	5.2	3.7	51.8	39.3	0.76

[a]Moisture-free basis.

[b]Convex shape.

[c]Medium size (8" dia.).

number of samples from more varieties will be useful in verifying the observed variations.

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Sunflower Oil Quality and Quantity As Affected by Rhizopus Head Rot

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ABSTRACT

Sunflower seed (*Helianthus annus* L.) from plants infected with head rot caused by *Rhizopus* spp. exhibited serious oil quality problems. Free fatty acid content of this oil was 19.4%, compared with 0.8% for oil from seed of healthy plants. Oil from diseased seed was also higher in palmitic, stearic, arachidic, behenic and lignoceric fatty acids. In addition, diseased plants yielded only 81% as much seed and only 55% as much oil.

INTRODUCTION

Although historically considered a disease of little consequence (1,2), head rot of sunflower (*Helianthus annuus* L.) caused by *Rhizopus* spp. (probably *R. arrhizus* Fischer) reduced yield up to 60% in some fields in Texas in 1977. The increasing incidence of plants infected with Rhizopus is largely due to poor insecticidal control of the sunflower moth [*Homoeosoma electellum* (Hulst)] (3,4). Feeding by larvae of this moth predisposes the head to Rhizopus infection.

Little is known about the effects of this disease on oil quality in sunflower (2,5,6). Our objectives were to more adequately define oil quality of infected heads, and to determine the impact of this disease on oil and achene yields.

MATERIALS AND METHODS

One hundred 'Hybrid 896' sunflower heads infected with Rhizopus head rot and containing sunflower moth larvae were havested from our sunflower nursery at Bushland, Texas, in July of 1977. Heads from healthy plants in the same nursery served as controls. All heads harvested appeared to have physiologically mature seed. Head diameter was determined for each head, as well as percent of the head covered with Rhizopus infection and insect frass. These two latter measurements will subsequently be referred to as percent Rhizopus and percent frass. Seed samples were taken from three areas of the heads: (A) the Rhizopus-infected part of the head, (B) a portion of the head covered only with frass from feeding larvae of the sunflower moth, and (C) from a healthy portion of the head (no Rhizopus or frass evident). The samples were taken by pressing a round steel container (5 cm diameter) into the upper surface of the sunflower head. All seed within the marked circle composed the sample. Fresh

TABLE I

Measurements of Sunflower Seed from (A) Rhizopus-Infected Part of Head; (B) Area of Head Covered with Frass from Sunflower Moth Larvae; (C) Uninfected, Nonfrass Area; and Seed from Healthy Plants (Control)

	Area of Rhizopus-infected head			
	A	B	C	Healthy control
Fresh weight of 100 seed (g)	9.2 b[d]	11.1 c	11.8 d	6.6 a
Dry weight of 100 seed (g)	4.1 a	4.1 a	4.4 a	5.2 b
Achene oil content (%)[a]	27.7 a	31.3 b	32.8 b	44.8 c
Oleic fatty acid (%)[b]	49.8 b	50.4 b	51.6 b	43.7 a
Linoleic fatty acid (%)[b]	35.3 a	34.3 a	32.9 a	43.8 b
Free fatty acid (%)[c]	19.4 b	0.6 a	0.6 a	0.8 a
Unfilled achenes (%)	5.7 b	1.7 ab	1.6 ab	0.0 a

[a]Dry-weight basis.

[b]Expressed as a percent of oil and determined by refractive index method.

[c]Expressed as a percent of oil.

[d]Mean values on each line followed by a common letter are not significantly different according to Duncan's multiple range test (0.01).