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Effect of growing season on the oil content percentage of five sesamum genotypes in six developmental stages

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Abstract
In the current investigation, the oil content percentage of five sesamum genotypes (Uma, Amrit, Nirmal, CUMS-17, Prachi) in six developmental stages (7 DAA, 14 DAA, 21 DAA, 28 DAA, 35 DAA and 42 DAA) were estimated in three growing seasons (summer, *kharif* and *rabi*). The field and lab experiments were carried out in Seed Science and Technology Department, OUAT, Bhubaneswar. The oil content percentage increased consistently up to 42 DAA but there was no significance difference between 35 DAA (maturity stage) and 42 DAA. Prachi and CUMS-17 (46.6%, 44.9%) recorded the highest oil content percentage in seeds throughout the period of seed development, respective at maturity stage and Uma was the lowest (41.6%). By comparing the three growing seasons, the *kharif* harvest seeds recorded the highest oil content (44.9%) followed by summer (43.5%) and *rabi* (42.6%) at maturity stage.

Keywords: DAA, maturity stage, *kharif*, rabi, summer

Introduction
Sesame is frequently known as Til and is used as edible oilseeds in India. It is cultivated in the country since antiquity. It is carrying about 21.5 per cent protein, 60.8 per cent fat, 8.9 per cent carbohydrate and 3.4 per cent ash (Nanda & Agrawal, 2009) [3]. Sesame seeds contain sesamolin, sesamin and sesamol like a lot of natural anti-oxidant health benefiting compounds. Sesamin also contain Vitamin B-complex. Niacin is found abundantly in sesamin. It reduces LDL- cholesterol levels in blood. It enhances GABA activity in the brain which helps reducing anxiety and neurosis. 73 per cent of the sesamum oil is used for edible purposes, 8.3 per cent for hydrogenation and 4.2 per cent for industrial purposes in manufacture of paints, pharmaceuticals and insecticides. This is also used in soap, cosmetic and skin care industries. It is very stable, anti-bacterial, anti-viral, anti-fungal and anti-oxidant. Though this oil is cholesterol free, it is used in health food industries. Seed is the cardinal unit of agriculture which gives maximum return in crop production to the farmer. Production, distribution and timely supply of quality seeds are therefore, inevitable to boost the production because no agriculture practice can improve the productivity beyond the limit set by the seed. Seed quality depends on a larger number of factors such as environmental, biotic, physical and physiological. Among several factors, the main problem for low yield is the non-availability of quality seeds. Quality seeds are important input in crop production. Among various factors affecting quality seed production, the influence of growing season appears significant in expression of various morphological, physiological and biochemical traits which ultimately determines the productivity of crop and sowing quality of seed (Nema, 1991) [4]. Therefore, selection of appropriate growing season is important while planning for seed production. High seed quality in terms of viability and vigour and biochemical parameters are essential factors which determine faster and better seedling development and crop establishment in field for receiving higher seed yield besides its better quality. Seeds become worthless if they fail to germinate and give high result (Heydecker *et al*., 1975) [2]. This study was undertaken to investigate the effect of growing seasons on the oil content percentage of five sesamum genotypes in six developmental stages.

Materials and Methods

Collection of sample

Seeds of five varieties/genotypes of sesame (Uma, Amrit, Nirmal, CUMS-17 and Prachi) were used in this experiment and the Breeder seeds were collected from AICRP on sesame, OUAT. Bhubaneswar. The seed crop of each treatment and replication were grown in *kharif*, *rabi* and summer, and seeds of remaining twenty capsules, harvested at each developmental stage for each replication and genotype, were separated, dried and used for oil extraction purposes.

Extraction and collection of oil content:

Fats are the fatty acid esters of glycerol. Fat as liquid is called oil. Seeds of sesamum contain oil as reserve food material for the embryo. Oil from a known quantity of sesamum seed is extracted by using petroleum ether. After that, it is then distilled off completely, then dried properly, and oil weighted and the oil percentage is calculated.

Materials required

Petroleum ether (40-160 ^{o}C), Whatman No. 2 Filter paper, Absorbant cotton, Soxhlet apparatus.

Procedure

1. First fold a piece of filter paper in such a way that it properly holds the seed meal. After that, wrap around a second filter paper which is left open at the top like a thimble. A piece of cotton wool is placed at the top to evenly distribute the solvent as it drops on the sample during extraction.
2. Sample packet place in the butt tubes of the Soxhlet extraction apparatus.
3. Extraction of oil mixed with petroleum ether (150 drops/min) for 6 hr without interruption by gentle heating.
4. Allow to cool the extraction flask and then dismantle the extraction flask. Evaporate the ether by using a steam or water-bath until no odour of ether remains. Cool it at room temperature.
5. The dirt or moisture which is placed outside the flask remove carefully and then weigh the flask. Repeat the heating until constant weight is calculated.

Calculation of oil content

Oil (%) in ground sample = Weight of oil (g)/ Weight of sample (g) × 100

Results

Changes in oil content with progress in seed development of individual varieties in different growing seasons could be revealed through [Table-1, 2, 3, 4]. The oil content of developing seeds increased consistently up to 42 DAA but there was no significant difference between 35DAA and 42DAA. Irrespective of growing seasons, Prachi and CUMS-17 recorded the highest oil percentage in seeds throughout the period of seed development, possessing 46.6% and 44.9%, respectively at maturity stage. In contrast, Uma consistently recorded the lowest value for this trait throughout the period of seed development with 41.6% at maturity stage. The comparative performance of sesamum varieties in respect of this parameter indicated considerable variation among the growing seasons. The *kharif* seeds had the highest oil content (44.9%) followed by the summer (43.5%) and *rabi* (42.6%) seeds at maturity stage.

Table 1: Changes in oil content (%) at different maturity stages in five sesamum varieties under summer season

Variety	Days after anthesis (DAA)					
	7	14	21	28	35	42
UMA	20.5	30.7	35.9	40.3	41.2	41.2
AMRIT	21.3	31.0	37.4	41.7	42.0	42.0
NIRMAL	21.7	31.4	38.1	42.1	42.7	42.7
CUMS-17	22.7	32.4	38.8	44.3	45.4	45.4
PRACHI	24.1	34.9	40.8	45.2	46.0	46.0
MEAN	22.0	32.1	38.2	42.7	43.4	43.5
SEm(±)	0.59	0.80	0.98	1.08	1.13	1.13
CD(0.05)	1.82	2.48	3.01	3.33	3.47	3.47

Table 2: Changes in oil content (%) at different maturity stages in five sesamum varieties under *kharif* season

Variety	Days after anthesis (DAA)					
	7	14	21	28	35	42
UMA	24.8	34.6	36.5	40.5	43.0	43.0
AMRIT	25.8	35.3	37.6	42.1	43.3	43.3
NIRMAL	27.0	36.1	38.9	42.3	44.2	44.3
CUMS-17	27.2	37.0	39.8	45.0	45.5	45.5
PRACHI	28.2	39.4	42.1	45.6	48.2	48.2
MEAN	26.6	36.5	39.0	43.1	44.9	44.9
SEm(±)	0.71	1.02	0.98	1.08	1.15	1.14
CD(0.05)	2.19	3.13	3.02	3.34	3.54	3.52

Table 3: Changes in oil content (%) at different maturity stages in five sesamum varieties under *rabi* season

Variety	Days after anthesis (DAA)					
	7	14	21	28	35	42
Uma	19.3	30.5	35.2	38.9	40.6	40.7
Amrit	19.9	31.0	35.7	41.1	41.3	41.3
Nirmal	20.1	31.2	36.2	41.6	41.7	41.7
Cums-17	20.6	32.6	38.2	42.7	43.6	43.6
Prachi	22.2	34.8	39.9	44.4	45.6	45.6
Mean	20.4	32.0	37.1	41.7	42.6	42.6
SEm(±)	0.52	0.82	0.95	1.04	1.12	1.12
CD(0.05)	1.61	2.52	2.91	3.22	3.44	3.44

Table 4: Overall changes in oil content (%) at different maturity stages in response to varieties and growing seasons

Variety/Season	Days after anthesis (DAA)					
	7	14	21	28	35	42
Variety						
Uma	21.5	31.9	35.9	39.9	41.6	41.6
Amrit	22.3	32.4	36.9	41.6	42.2	42.2
Nirmal	22.9	32.9	37.7	42.0	42.9	42.9
Cums-17	23.5	34.0	38.9	44.0	44.8	44.9
Prachi	24.8	36.4	40.9	45.1	46.6	46.6
SEm(±)	0.35	0.51	0.56	0.62	0.65	0.65
CD(0.05)	1.02	1.47	1.60	1.77	1.87	1.87
Season						
Summer	22.0	32.1	38.2	42.7	43.4	43.5
Kharif	26.6	36.5	39.0	43.1	44.8	44.9
Rabi	20.4	32.0	37.1	41.7	42.6	42.6
Overall mean	23.0	33.5	38.1	42.5	43.6	43.7
SEm(±)	0.33	0.50	0.36	0.60	0.59	0.58
CD(0.05)	0.95	1.43	1.02	1.71	1.68	1.68

Discussion

In the present study, oil content of seed was estimated at weekly intervals from the day of anthesis in all the five varieties in all the three seasons. The results indicated a rapid increase at the initial stage up to two weeks followed by a steady increase up to 35 DAA after which there was either no change or little rise in the oil content of seeds. The pattern of

change was sigmoid as was observed in dry matter accumulation. Although all the varieties showed similar trend of change, they differed in the magnitude with the highest value found in Prachi followed by CUMS -17. The seed oil content of these two varieties at maturity stage was 46.6% and 44.9%, respectively. Besides this, the lowest oil content (41.6%) in mature seed was observed in Uma. Seeds produced in different seasons also differed significantly in their oil content. The *kharif* seeds possessed higher oil followed by those produced in summer and *rabi* in that order. The better plant growth in *kharif* and summer seasons favoured better photosynthesis thereby higher oil content in seeds. The result of the investigation is in agreement with those of Awasthi and Pathak (1993) [1] and Paramjit *et al*., (1995) [5] who reported similar pattern of accumulation and genotypic variability in seed oil content of mustard.

Conclusion

Accumulation of soluble protein and oil in developing seeds increased gradually with progress of seed maturity and attained the highest values around 35 DAA. The pattern of enhancement was sigmoid as was observed in dry matter accumulation in developing seeds. Among the varieties, Prachi and CUMS-17 and among the seasons, seeds produced in *kharif*, exhibited higher values in respect of these two biochemical traits. The activity of alpha-amylase and dehydrogenase in developing seeds also followed similar trend of enhancement in respect to pattern of increase, genotypic and seasonal variations.

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