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Varietal variation and seasonal influence on the pattern of accumulation of old and protein in the Developing cotton seed*

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Accumulation of oil was observed from the 5th day after anthesis in all the six varieties studied in both winter and summer seasons. The oil content was maximum between 30 and 40 days in all the varieties in both the seasons. Among the varieties, in the matured seed, the percentage of oil ranged from 18.10 to 20.30 in winter and from 18.40 to 20.95 in summer. The rate of oil accumulation was more rapid in winter than in summer in all the varieties.

The formation of protein was observed from the 10th day after anthesis in all the varieties in both the seasons. The protein content was maximum between 40 and 55 days in different varieties in both the seasons. Among the varieties the protein content at maturity, ranged from 15.11 to 18.90 per cent in winter and from 14.48 to 19.76 per cent in summer. The extent of variation in protein content between varieties was comparatively narrow in winter than in summer.

In the cotton seed, oil and protein constitute the major stored food materials and play an important role in seed germination and subsequent growth of seedlings. The pattern and amount of accumulation of oil and protein in the seed may be varying within a variety between seasons and between varities with a season. Information on this aspect may be useful in correlating the relationships between these two nutrients and seed quality. With this end in view preliminary investigations were carried out in six varieties of Cotton.

MATERIAL AND METHODS

Pure seeds of six popular varieties viz., MCU4, MCU5, MCU7 MCU8 and PRS 72 of *Gossypium hirsutum* and Suvin of *G. brabadense* were obtained from the Department of Agricultural Botany, Tamil Nadu Agricultural University. MCU4, MCU5, MCU8 and Suvin are long duration varieties (LDVS) maturing in about 165-180 days while MCU7 and PRS72 are short duration varieties (SDVS) of 135-140 days of maturity. Two field trials were laid out, one in winter season 1975 and the other in summer season 1976. The trials were laid out in completely randomised design with three replications. In winter, sowing was taken up during the last week of August and in-summer during the last week of February. The packages of practices recommended for the varieties were followed. Each variety was raised in sixty rows with

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20 plants in each row in both the seasons. As soon as the flowering commenced, sufficiently large number of flowers were tagged with date of flowering in both the seasons and selfed. Fifteen bolls were collected at random from each variety in each replication at five days interval. In the case of long duration varieties, bolls were collected upto 55th day while in the short duration varieties, upto 45th day. Thus, eleven samples representing eleven periods of five days duration from P_1 to P_{11} in the long duration varieties and nine samples representing nine periods (P_1 to P_9) were available. The seed obtained from 15 bolls from all replications were pooled and samples were drawn to estimate the oil and protein. Oil and protein contents were estimated adopting the procedure suggested by Christiansen and Moore (1961) and Ali Khan and Young (1973) respectively.

RESULTS AND DISCUSSION:

(i) *Oil*: (Table 1)

In both the seasons, up to 5 days after anthesis oil formation was not observed among the varieties. On the 10th day, the percentage of oil among the varieties ranged from 0.40 $(V)_1$ to 0.80 (V5).

In winter season, significant variation in oil content was observed for periods from P_3 to P_9 among the LDVS whereas in V_8 and V_9, the difference in oil content was significant only at P_7. The percentage of increase in oil accumulation was maximum between P_8 and P_4 in V_8 (306.0) and V_9 (417.0) and between P_8 and P_9 in V_1 (221.0), V_2 (114.0) V_3 (199.0) and V_4 (105.0). The oil content was maximum at P_9 in V_1, V_2 and V_4. at P7 in V_8 and at P6 in V_9. Among the varieties the percentage of oil ranged between 19.65 (V6) to 25.70 (V_4). The long duration varieties recorded significantly more oil than the short duration varieties at this stage. After this period, the oil content decreased till boll bursting and the percentage of decrease ranged between 7.9 (V6) to 21.1 (V_4) The decrease was significantly more in the LDVS than in the SDVS. At P_{11}, V_4 while on par with V_2, and V_2 was superior to V_1.

In summer also oil formation was recorded from P2 onwords. The percentage of oil at this stage ranged from p. 35 (V1) to 1.45 (V6). At this stage the seeds of LDVS contained significantly more oil than the SDVS. Significant variation was observed in all the periods in the LDVS and only at P_7 and P_8 in the SDVS. The pattern of increase was more or less uniform among the LDVS only. The percentage of increase was maximum between P6 and P7 in V_1 (85.5). V_2 (5.0), V3 (108.1) and V_4 (142.2) and between P_4 and P_9 in V_8 (82.7) and V_9 (88.2). The maximum oil content was recorded at P_8 in all varieties except V_8 which was at P7. The percentage of oil at this stage ranged from 21.00 (V_9) to 26.25 (V_4). After this stage, the oil content decreased till boll bursting and the percentage of decrease ranged between 12.3 (V_9) and 21.9 (V_4). The rate of decrease was comparatively more in the LDVS than in the SDVS. The oil content at maturity was 20.00 (V_1), 19.75 (V_2)

19.75 (V_1) 19.60 (V3), 20.95 (V_4) 18.50 (V_5) and 18.40 (V_6) percent. The variation between the LDVS and the SDVS was significant.

In all the varieties, the rate of accumulation of oil was more rapid and earlier by five days in winter than in summer. ii) Protein (Table 2.)

Formation of protein was almost nil upto P_8 in all the varieties in both the seasons. In winter, accumulation of protein was recorded at P_8 which ranged between 4.44 (V_1) to 5.16 (V_6) percent. There was no significant varietal differences at this stage. But between P_4 and P_9 in the SDVS and between P_8 and P_9 in the LDVS significant differences were observed. The pattern of accumulation of protein between periods among the varieties was not uniform. The percentage of increase was maximum between P_6 and P_7 in V_1 (168.9), V_3 (114.1), V_2 (181.2) and V_4 (190.7) and between P_4 and P_5 in V_5 (50.5) and in V_6 (75.). The protein content was maximum at P_{10} in the LDVS and at P_9 in the SDVS and at these stages, the percentage of protein content ranged between 17.75 (V3) to 18.53 (V_4) in the LDVS and between 15.87 (V_6) and 19.20 (V_5) in the SDVS. The variation was significant only in the SDVS. After this stage, the protein content decreased till boll bursting and the percentage of decrease ranged between 1.5 (V5) and 6.4 (V4). The protein content at maturity stage ranged from 17.16 (V_1) to 17.87 (V_2) percent in the LDVS and from 15.11 (V_6) to 18.90 percent (V_4) in the SDVS. The variation was significant only in the SDVS.

In the summer season, from P3 to P9 the mean protein content among the LDVS was significantly more than in the SDVS. Among the LDVS, the variation in protein content was significant for the period from P4 to P11, whereas among the SDVS, it was from P_3 to P . The protein content at P_3 ranged from 4.22 (V_3) to 5.84 (V_5) percent.

The accumulation of protein was maximum between P6 and P7 in V_1 (49.4%), V_3 (36.6%) and V_4 (17.92%), between P_8 and P in V_2 (68.5%); between P_4 and P_5 in V_5 (92.4), and between P_7 and P_8 in V_6 (93.6%). The protein content was maximum at P_{11} in V_1, V_2 and V_4; at P_{10} in V_3 and at P_9 in V_5 and V_6 and ranged between 15.00 (V_6) and 20.63 (V_5) percent. A decrease in protein content was noticed in the subsequent stage in V_1 (2.4%), V_3 (1.1%) and V_6 (3.5%) only. At maturity, the percentage of protein ranged from 16.41 (V_3) to 19.76 (V2) in the LDVS and from 14.43 (V6) to 20.41 (V5) in the SDVS.

The extent of variation among varieties was comparatively less in winter than in summer. The maximum accumulation of protein took place five days later in summer than in winter in LDVS.

The rate and period of oil formation in cotton seeds, according to Turner *et al.*, (1976) varied within and between varieties due to seasons and locations. In the present study, oil accumulation was rather intensive between 15-30 days in winter and between 25-35 days in summer. The

oil content reached the maximum between 30 and 40 days in winter and between 35 and 40 days in summer. The rate of accumulation was more rapid in SDVS than in LDVS. Toschevikova *et al.* (1957) observed that the accumulation of oil in the early maturing variety proceeded at a faster rate than in seeds of late ripening variety. The rate of accumulation was more rapid in winter than in summer. Gallup (1927). Grindley (1950), Caskey *et al.* (1931), Louzinger *et al.* (1931), Kamel (1951), Ali *et al.* (1963) and Memon *et al.* (1969) have reported similar results.

The rate of accumulation of oil compared to that of protein was faster and the period of maximum accumulation was shorter in most of the varieties in both the seasons. The extent of variation in protein content among the varieties was more during summer than in winter. This is in confirmity with the results of Turner *et al.* (1976) and El-Nockrasky *et al.* (1976).

A comparative study of the pattern of accumulation of oil and protein in the seed with germination revealed that the seeds are capable of germination when the rate of accumulation of oil and protein was maximum. However, maximum germination was observed when the accumulation of protein has come to an end.

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Table : 1 Mean percentage of oil content in seeds recorded at 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55 days after anthesis in six varieties of cotton

Varieties / Season	MCU 4 (V1)	MCU 5 (V2)	MCU 8 (V3)	SUV IN (V4)	MCU 7 (V5)	PRS 72 (V6)
W P1	–	–	–	–	–	–
S „	–	–	–	–	–	–
W P2	0.40	0.40	0.40	0.65	0.80	0 70
S „	0.35	0.42	0.60	0.85	1.00	1.45
W P3	1.35	2 50	1.65	2.50	2.50	2.00
S „	1.35	1.35	0.95	2.05	2 05	2.45
W P4	1.55	3.00	2.15	3.05	10.15	10.35
S „	2.30	2.45	1.95	3.50	3.95	3.55
W P5	3.70	5.65	5.34	9.00	16.76	16.25
S „	5.95	6 40	3.70	4.45	9.55	8.90
W P6	14.60	17.10	16.35	18.45	19.86	19.65
S „	10.00	9.00	8.05	7.70	17.45	16.55
W P7	21.95	23.90	23.45	25.70	20.0(	18.50
S „	18.55	17.55	16·80	18.65	22.9!	20.40
W P8	22.65	23.90	22.50	25.70	18 0(	17.60
S „	22.05	24.90	23.75	26 25	19.6!	21.00
W P9	22.50	23.55	21.70	28.65	18.5!	18.10
S „	22.30	22.95	21.20	24 75	18.5!	18.40
W P10	20 35	20.35	19.45	19.90	–	–
S „	20.70	21.60	21.75	22.65	–	–
W P11	18.90	19.10	19.45	19.90	–	–
S „	20.00	19.75	19.60	20.95	–	–

Comparison of			All Vars.	LDVS
(i) variety × period	SEd		0.42	0.42
	CD (P=0		0.83	0.83
(ii) season × variety × period	SEd		0.60	0.59
	CD (P=(		1.19	1.18

TABLE 2 Influence of season on the mean percentage of protein content of seeds recorded at 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 and 55 days after anthesis in six varieties of cotton.

Varieties Season/ Period	MCU 4 (V1)	MCU 5 (V2)	MCU 8 (V3)	Suv in (V4)	MCU 7 (V5)	PRS 72 (V6)
W P3	4.44	4.68	4.76	4 75	5 05	5 16
S „	4.96	5 07	4.22	4 97	5.84	4 98
W P4	4.76	4 62	4 90	4 76	7 99	6 83
S „	8 05	7 60	6 00	4 80	6 48	9 64
W P5	6 92	5.03	5.54	6.01	12 03	11.99
S „	8 81	8.05	8 01	7 61	12.47	9.42
W P6	6 07	7 33	5 61	5.69	10 87	8.24
S „	9 46	13 57	10 99	5.77	12.82	11.77
W P7	16.32	15 70	15 79	16.55	17 41	14 72
S „	14.14	15.83	15.02	16 02	16 98	13 91
W P8	16 46	16.25	16 44	13 62	19 20	15 87
S „	10 88	24 22	12 97	17.24	20.63	15 00
W P9	15 56	15 95	16·35	16 40	18 90	5 11
S „	12.15	18 28	16 01	18.93	20.41	14.48
W P10	17 90	18.28	17 75	18 53	–	–
S „	17.33	19.34	16.82	14 79	–	–
W P11	17 16	17 87	17.06	T7 34	–	–
S „	17 47	19.76	16 41	19 50	–	–

		All Var	LDVS
Variety × period	SED	0.72	0 72
	CD [P=0.05]	1 63	1.43
Season × variety × period	SEd	1.02	1 02
	CD (P=0.05)	2.02	2.03