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Seed development and maturation in sesame (CV. Prachi) as influenced by growing seasons

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Abstract

An investigation has been planned to study the influence of growing season on the pattern of seed development and maturation in sesamum. Seed crops of sesame cv. Prachi were grown during summer-2015, *kharif* -2015 and *rabi* 2015-16 at the Central Research station OUAT, Bhubaneswar, adopting recommended package of practices. Observation on various capsule and seed characteristics were recorded at weekly intervals from the 7th day of anthesis (DAA) up to 42 days. Capsule length and dry weight of seeds showed a steady increase upto 35 days. Capsule width (0.733 cm) increased up to 28 days and thickness (0.894 cm) increased up to 21 days and then decreased slowly up to maturity. The physiological maturity of seeds reached between 35-42 days. Although, seed germinability attained on the 14 DAA, the maximum germination (93.833%) and vigour reached around physiological maturity stage. The dry seed weight, an important determinant of seed yield and quality was the highest (0.183g) in *kharif* followed by that in summer (0.153g) and the least (0.101g) in *rabi* season. Considering the seed quality parameters, *kharif* and summer season appears to be ideal time for quality seed production in sesame.

Keywords: Sesame, seed development, seed quality, seasonal influence

Introduction

High quality seed is essential for better field establishment and productivity of crops. Pre-harvest environmental conditions and degree of seed maturity are important factors that determine the quality of seed and their longevity in storage^[1, 2]. Therefore, it is essential to determine the ideal planting time and stage of harvest of seed crops for obtaining seeds of high longevity. Although, attainment of physiological maturity of seed is under genetic control, it is influenced by environmental factors^[3, 4]. Seed maturation refers to the morphological, physiological and functional changes that occur from the time of fertilization until the mature seeds are ready for harvest^[5]. Tracing the sequence of seed development and fixing the time for maturity have more practical utility in getting higher quantity of quality seeds. Sesame, being an important oil seed crop of the country, is grown in all the three growing season. Due to its nutritional and medicinal values, the crop is now gaining importance among the farmers, for which the demand of quality seed is increased. There is need to increase quality seed yield of the crops, to meet the growing demand of farmers. The present investigation has been planned to study the influence of growing season on the pattern of seed development and maturity in sesame and to find out the ideal planting time to successfully take up seed production programme of this crop.

Materials and Methods

The seed crops of sesame cv. Prachi were grown at the Central Research Station, Orissa University of Agriculture and Technology, Bhubaneswar, Orissa during summer-2015, *kharif* - 2015 and *rabi*- 2015-16, adopting recommended package of practices^[6, 7]. Sufficient number of plants of uniform growth was marked. The mature flower buds that would open on the subsequent day were tagged coinciding with 50% flowering stage of the crop. The capsules that developed on the tagged flowers were collected at weekly intervals commencing from the 7th DAA and a total of six samples were taken. At each sampling, sufficient numbers of capsules were collected to record observations, viz. length, width, thickness of capsules, fresh and dry weight of seed, germination percentage, seedling length and dry weight. Standard procedures were followed for determination of germination percentage of seeds^[8] and length and dry weight of seedlings^[9].

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Results and Discussion

Among the capsule characteristics, the capsule length increased at a relatively faster rate (1.855 cm) up to 14 DAA and reached the maximum value (2.101 cm) on 35 days and then the value was same up to maturity. The capsule width and thickness increased up to 21 DAA reached their maximum values and then decreased slowly up to maturity. The pattern of development of these traits in different seasons (Table 1-3) indicated that the capsules were relatively larger in size and heavier in *kharif* season closely followed by summer and the values were the least in *rabi* season. The restricted capsule growth during *rabi* season may be due to low temperature prevailing during this season.

The weight of fresh seeds showed a rapid initial increase up to 14 days and reached the maximum value (0.200 g) followed by gradual decrease up to maturity (Table-4) due to slow rate of desiccation. On the other hand, the dry seed weight showed

a rapid initial increase up to 14 days (0.058 g), then gradual increase up to 35 days, reached the maximum value (0.284g) and then slightly decreased. This indicated that the physiological maturity in this variety of sesame, as measured by attainment of maximum dry weight, have attained between 35 and 42 DAA. The developmental pattern of those seed traits showed similar trend in all the three seasons (Table 1-3). However, the seeds produced in *kharif* season were comparatively heavier (0.183g) in comparison to that of summer (0.153g) and *rabi* season (0.101g). The low temperature during this season might have restricted translocation of photosynthates into the developing seeds that resulted in poor seed development. A similar study in mustard by Chamling ^[10] indicated the attainment of maximum fresh weight and dry weight of seed at 21 and 35 DAA, respectively.

Table 1: Changes in the developmental and quality traits of capsules and seeds in *Sesamum cv. Prachi* at different growth stages, grown in summer season.

Name of the traits	Days after anthesis							GM	SEm(±)	CD(0.05)
	7	14	21	28	35	42				
Fresh seed weight(g)	0.040	0.174	0.168	0.158	0.145	0.138	0.137	0.002	0.062	
Dry seed weight(g)	0.030	0.050	0.060	0.113	0.153	0.140	0.091	0.003	0.0084	
Capsule length(cm)	1.675	1.900	2.110	2.140	2.188	2.188	2.033	0.046	0.1381	
Capsule width(cm)	0.553	0.600	0.800	0.770	0.760	0.760	0.707	0.016	0.0484	
Capsule thickness(cm)	0.725	0.763	0.905	0.900	0.893	0.888	0.845	0.021	0.0636	
Germination (%)	0	40.668	63.925	77.000	93.000	94.500	61.515	2.157	6.5014	
Seedling length(cm)	0	5.243	5.373	5.455	5.520	5.538	4.521	0.325	0.9784	
Seedling dry weight(g)	0	1.193	2.103	2.150	3.175	3.230	1.975	0.067	0.2030	
SVI-I	0	213.110	346.269	422.860	514.208	524.063	336.751	30.238	91.1459	
SVI-II	0	48.503	134.200	165.750	295.000	305.030	158.080	6.863	20.6861	

*SVI- Seed vigour Index, GM- Grand mean

Table 2: Changes in the developmental and quality traits of capsules and seeds in *Sesamum cv. Prachi* at different growth stages, grown in *kharif* season.

Name of the traits	Days after anthesis							GM	SEm(±)	CD(0.05)
	7	14	21	28	35	42				
1. Fresh seed weight(g)	0.081	0.251	0.211	0.193	0.184	0.191	0.185	0.005	0.0156	
2. Dry seed weight(g)	0.040	0.083	0.083	0.153	0.183	0.170	0.118	0.005	0.0149	
3. Capsule length(cm)	1.938	2.140	2.233	2.295	2.395	2.400	2.233	0.036	0.1079	
4. Capsule width(cm)	0.605	0.650	0.733	0.785	0.785	0.785	0.724	0.025	0.0765	
5. Capsule thickness(cm)	0.770	0.825	0.875	0.860	0.860	0.860	0.842	0.051	NS	
6. Germination (%)	0	42.668	82.120	88.250	94.250	94.750	67.006	6.248	18.8338	
Seedling length(cm)	0	5.363	5.498	5.683	5.748	5.788	4.680	0.139	0.4180	
Seedling dry weight(g)	0	1.358	2.270	2.750	3.345	3.360	2.180	0.075	0.2272	
9. SVI-I	0	229.158	450.240	503.730	542.330	548.663	379.020	34.031	102.5811	
10. SVI-II	0	57.605	186.645	241.813	290.623	318.713	182.566	18.257	55.0337	

Table 3: Changes in the developmental and quality traits of capsules and seeds in *Sesamum cv. Prachi* at different growth stages, grown in *rabi* season.

Name of the traits	Days after anthesis							GM	SEm(±)	CD(0.05)
	7	14	21	28	35	42				
Fresh seed weight(g)	0.062	0.173	0.158	0.115	0.108	0.103	0.120	0.004	0.0110	
Dry seed weight(g)	0.030	0.040	0.043	0.083	0.101	0.093	0.065	0.004	0.0109	
Capsule length(cm)	1.125	1.525	1.630	1.720	1.720	1.715	1.573	0.087	0.2611	
Capsule width(cm)	0.505	0.600	0.660	0.643	0.643	0.643	0.615	0.013	0.0379	
Capsule thickness(cm)	0.600	0.800	0.903	0.860	0.860	0.860	0.814	0.018	0.0550	
Germination (%)	0	29.668	60.000	62.333	90.000	92.250	55.708	1.603	4.8335	
Seedling length(cm)	0	5.145	5.263	5.373	5.458	5.463	4.450	0.322	0.9707	
Seedling dry weight(g)	0	1.193	1.333	2.100	2.703	2.710	1.673	0.064	0.1934	
SVI-I	0	151.183	316.600	335.893	486.765	504.163	299.100	26.683	80.4303	
SVI-II	0	35.373	80.115	130.490	243.005	249.830	123.135	5.532	16.6761	

*SVI- Seed vigour Index, GM- Grand mean

Table 4: Changes in the developmental and quality traits of capsules and seeds in *Sesamum* cv. Prachi at different growth stages (Mean of three seasons)

Name of the traits	Days after anthesis								
	7	14	21	28	35	42	GM	SEm(±)	CD(0.05)
Fresh seed weight(g)	0.061	0.200	0.179	0.155	0.145	0.144	0.147	0.008	0.0217
Dry seed weight(g)	0.033	0.058	0.062	0.116	0.284	0.134	0.114	0.064	0.1808
Capsule length(cm)	1.579	1.855	1.991	2.052	2.101	2.101	1.946	0.058	0.1648
Capsule width(cm)	0.554	0.617	0.731	0.733	0.729	0.729	0.682	0.022	0.0627
Capsule thickness(cm)	0.698	0.796	0.894	0.873	0.871	0.869	0.834	0.035	0.0990
Germination (%)	0	37.668	68.682	75.861	92.417	93.833	61.410	4.346	12.3160
Seedling length(cm)	0	5.250	5.378	5.503	5.575	5.596	4.550	0.251	0.7115
Seedling dry weight(g)	0	1.248	1.902	2.333	3.074	3.086	1.940	0.109	0.3089
SVI-I	0	197.817	371.036	420.828	514.434	525.629	338.291	30.882	87.5235
SVI-II	0	47.160	133.653	179.351	276.209	291.191	154.594	14.882	42.1786

*SVI- Seed vigour Index, GM- Grand mean

The germination of seeds was attained around two weeks after anthesis, reached (37.668%) on the 14 DAA followed by rapid increase to 62 percent within one week and then slowly increased and reached the maximum value (93.833%) at maturity (Table-4). There was positive association between dry matter accumulation and improvement in germination percentage of seeds. Although the final germination percentage of maturity stage of seed was same in all the seasons, the rate of improvement was rapid in *kharif* in comparison to summer and *rabi* season (Table 1-3). In similar study, Rajsekaran *et al.*, [11] reported that although germination of seeds attained after 15 DAA, the maximum germination (94%) was observed at 35 DAA.

The seedling length and seedling dry weight which are the measures of seed vigour showed similar trend of improvement like germination. These traits showed a rapid initial increase up to 21 days followed by relatively slow rate of improvement up to 42 days (5.596 cm and 3.086g) (Table-4). The seed vigour-I and seed vigour-II was found maximum, 525.629 and 291.191 up to 42 days. The improvement in seed germination and vigour were associated with dry matter accumulation in the developing seeds [12].

The results of the study suggested that the physiological maturity of sesame seeds attained between 35 to 42 days after anthesis where the dry matter, germination and vigour were at their maximum value. Considering the boldness of capsule, seed and seed quality, the *kharif* and summer seasons appears to be the most favourable time for quality seed production in sesame.

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