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Accelerated Aging in Legume for Physiological Response

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Abstract: ***Seed physiology is an important factor in the seed potentiality for long period. Deterioration in the crop not clearly seems in seeds mostly by the normally measurable parameters, it needs to expose the seeds into stress-able artificial environment; hence we going for testing of several soybean genotypes for their physical potentiality with artificial made adverse condition. The condition with 100% relative humidity and 41±1°c temperature, upto 3(72h) days; initial and the final weight of the seeds were measured in gm, it was showed the variable difference in gaining the moisture content by the genotypes, some genotypes showed gaining high moisture while some were less. The electrical conductivity of said genotypes also checked and it will showed variance according to the physiological response. Germination %, Vigour Index (Mass, Length) % also measured it's also variates ratio in genotypes. The strong and physiological potential genotypes sustain and maintain their vigour parameters in adverse climatic condition.***

Keywords: Accelerated aging, Seed germination, Electrical conductivity, Vigour Index

1. Introduction

Glycine max (L). Merill called as Soybean in local, belonging to family Leguminoceae, with pink flowered, major growing in Kharif season, its well grown in black, saline, and clay soil of a yield of 25-30 quintals per hectare.

Glycine max (L). Merill growing all over the world as an oil crop as well as for food and fodder purpose, high in nutritional value, soybeans are an important source of cooking oil and of high-protein animal feed. Along with peas, beans, and peanuts, soybeans belong to the group of plants called legumes, great production in the United Nations, and 68% of whole used soybean as protein meal. There is increase in production and export of soybean crop day by day to till date. In comparison of world India is largely soybean producing country.

In India Madhya Pradesh one of the states in the country which produces high production of soybean, Maharashtra, Karnataka, Rajasthan, Gujarat also produces the soybean. In Maharashtra Latur district is take most top position in soybean production.

The performance of vigor and viability performing test by the accelerate aging test; good performance showed by stress test applied for screening genotypes in ambient storage of stored samples after 9 month. The some vigorous genotypes performed well potentiality to stress test; and showed the better germination in 9 month in ambient condition; while some genotypes correlated negative performance in stress test. The similar results concluded Out of 30 varieties/genotypes tested, Kalitur, MACS-1416, DSB-21, EC-18761, and CO1 were found to maintain maximum seed germination and seedling vigour and considerably less electrical conductivity of seed leachate after accelerated aging of 7 days, Vijayakumar, H.P and Vijayakumar, A. (2016).same results reported seed aging, both artificial and natural, caused damage to the seed, which negatively affected the quality, i.e. seed germination rate of the tested sunflower and soybean genotypes by Balesevic-Tubic, S., Tatic *et al* ;(2010).

The electrical conductivity test is known as one of the best evaluation of vigor in soybean seed (Abdul baki; Anderson, 1970; Yaklich et al., 1979; Loeffler et al., 1988; Marcos Filho, 1990) and it is recommended in the Manual Of Vigor Tests (ISTA, 1995) This test is recommended to evaluate vigor in pea seeds (ISTA, 2003; Bedford, 1974;Tekrony; Egli, 1977; Johnson; Wax, 1978; Oliveira et al., 1984; Vieira et al., 1999). EC test in soybean seed is more efficient indicator of field emergency than germination test.

The naturally and/or artificially aged or mechanically damaged seeds showed more conductivity than normal healthy seeds (Edge; Burries, 1970; Parrish; Leopold, 1978; Loeffler et al., 1988; Hampton, 1995).

The objective of given study to evaluate the physical performance of selected genotypes by using the accelerated aging test.

2. Materials and Method

Soybean MACS-450 was purposely cultivated in the growing season-June-2016, in the field of Ajeet Seeds Pvt.Ltd. Chitegaon, Aurangabad

All the testing genotypes for accelerated aging kept in (hanging in plastic jar over 5ltr distilled water) 100% relative humidity and 41±1°c temperature for 72hr.after testing period seeds was kept for soil, paper germination; electrical conductivity.

Germination- 25 seeds of each genotype kept for between paper germination, for vigour testing and 100 seeds for soil germination, after 5th day seedlings was evaluating in following category.

Normal seedlings-The seedling showed well continued growth of plumule and radicle is considered as normal seedlings

Abnormal seedlings- The seedling with retarded/ discontinued growth, absence of any one of the essential (plumule and radicle) were counted as abnormal seedlings

Fresh-ungerminated seeds- Those seeds which absorbs water, but do not showed any essential structure and end of the test period remains as it is it's called as fresh-ungerminated seeds.

Hard seeds- Those seeds are hard and not absorb the water in its testing periods due to hard seed coat confirm the hard seeds.

Dead seeds- decaying and decomposing matter comes out from seeds it absorbs water but fail to produce plumule and radicle refers dead seeds.

Seedling Length (cm)-at the end of germination period the each and every seedling measured in (cm), individually plumule and radicle.

Seedling weight (gm)-after taking seedling length weight of each seedling measured (gm) considered as fresh seedling weight.

Dry matter production- completing length and weight each genotype seedlings was kept in hot air oven for about 18hr at 103°c, after this removes seedling and cooled for 30 minutes and weight (gm) of dried seedling

Vigour Index (Length)-calculated as Germination % x Mean Seedling length

Vigour Index (Mass)-calculated as Germination % x Dry weight (gm) of seedling

Electrical conductivity ($\mu scm^{-1}g^{-1}$)-
Electrical conductance of genotypes measured by electrical conductivity meter, weighted 50 seeds placed in a closed glass bottles with 250ml of distilled water; kept it for 24hr, at 25°c temperature. Also blank only with the distilled water kept as control.

3. Result and Discussion

Table 1: Showing Seed Initial weight, Wt. after aging period, Wt. difference, Percent Moisture increase

ACCELERATED AGING TREATMENT						
SCREENED GENOTYPES IN M4 GENERATION AFTER 9 MONTH AMBIENT CONDITION						
Sr.No	Genotypes	Initial wt(gm)	Wt(gm)/72 hr	Diff.(gm)	% Moisture Increase	aged
1	GENO-1	17.55	20.19	2.64	15.04	0.15
2	GENO-2	18.92	21.59	2.67	14.11	0.14
3	GENO-3	18.03	21.09	3.06	16.97	0.17
4	GENO-4	18.39	21.07	2.68	14.57	0.15
5	GENO-5	17.29	20.02	2.73	15.79	0.16
6	GENO-6	16.7	18.91	2.21	13.23	0.13
7	GENO-7	18.22	20.8	2.58	14.16	0.14
8	GENO-8	21.71	24.58	2.87	13.22	0.13
9	GENO-9	17.45	20.17	2.72	15.59	0.16
10	GENO-10	19.8	22.83	3.03	15.3	0.15
11	GENO-11	20.74	24.01	3.27	15.77	0.16
12	GENO-12	20.2	23.08	2.88	14.26	0.14
13	GENO-13	19.95	22.79	2.84	14.24	0.14
14	GENO-14	19.29	22.35	3.06	15.86	0.16
15	GENO-15	20.52	23.25	2.73	13.3	0.13
16	GENO-16	17.93	20.37	2.44	13.61	0.14
17	GENO-17	19.84	23	3.16	15.93	0.16
18	GENO-18	17.79	20.36	2.57	14.45	0.14
19	GENO-19	18.41	21.6	3.19	17.33	0.17
20	GENO-20	20.02	23.6	3.58	17.88	0.18
21	GENO-21	19.03	22.1	3.07	16.13	0.16
22	GENO-22	17.59	20.76	3.17	18.02	0.18
23	GENO-23	17.63	20.84	3.21	18.21	0.18
24	GENO-24	18.71	22.25	3.54	18.92	0.19
25	GENO-25	19.23	23.2	3.97	20.64	0.21
26	GENO-26	19.23	23.29	4.06	21.11	0.21
27	GENO-27	18.77	21.99	3.22	17.16	0.17
28	GENO-28	18.68	22.33	3.65	19.54	0.20
29	GENO-29	17.91	21.16	3.25	18.15	0.18
30	GENO-30	18.65	21.7	3.05	16.35	0.16
31	GENO-31	18.29	21.58	3.29	17.99	0.18
32	GENO-32	20.13	23.63	3.5	17.39	0.17
33	GENO-33	24.04	28.27	4.23	17.6	0.18
34	GENO-34	17.92	20.87	2.95	16.46	0.16
35	GENO-35	17.77	20.32	2.55	14.35	0.14
36	GENO-36	16.86	19.61	2.75	16.31	0.16
37	GENO-37	18.6	21.2	2.6	13.98	0.14
38	GENO-38	18.51	21.52	3.01	16.26	0.16
39	GENO-39	17.89	20.86	2.97	16.6	0.17
40	GENO-40	16.99	19.88	2.89	17.01	0.17

41	GENO-41	17.71	20.26	2.55	14.4	0.14
42	GENO-42	18.25	21.42	3.17	17.37	0.17
43	GENO-43	19.98	23.04	3.06	15.32	0.15
44	GENO-44	17.35	20.47	3.12	17.98	0.18
45	GENO-45	18.96	21.94	2.98	15.72	0.16
46	GENO-46	19.45	22.8	3.35	17.22	0.17
47	GENO-47	19.72	23.05	3.33	16.89	0.17
48	GENO-48	17.7	21.04	3.34	18.87	0.19
49	GENO-49	17.82	20.29	2.47	13.86	0.14
50	GENO-50	21	24.08	3.08	14.67	0.15
51	GENO-51	23.07	26.07	3	13	0.13
52	GENO-52	17.91	20.43	2.52	14.07	0.14
SD±		***1.48***	***1.7***	***0.41***	***1.94***	***0.02***
SE±		***0.2***	***0.24***	***0.06***	***0.27***	***0***

Table 2: Showing Seed germination percentage, Electrical conductivity ($\mu scm^{-1}g^{-1}$), Vigour Index % (Length, Mass)

ACCELERATED AGING TREATMENT					
SCREENED GENOTYPES IN M4 GENERATION AFTER 9 MONTH AMBIENT CONDITION					
Sr.No	Genotypes	Ger.%	Electrical conductivity($\mu scm^{-1}g^{-1}$)	Vigour Index (Length)	Vigour Index (Mass)
1	GENO-1	100.00	45.27	1324.00	56.30
2	GENO-2	98.00	45.55	1228.92	53.02
3	GENO-3	100.00	47.14	1692.00	63.70
4	GENO-4	98.00	37.47	1330.84	56.94
5	GENO-5	100.00	30.15	1363.00	50.40
6	GENO-6	100.00	38.01	1400.00	62.20
7	GENO-7	88.00	41.38	1173.04	51.74
8	GENO-8	92.00	35.52	1239.24	50.05
9	GENO-9	100.00	33.41	1344.00	54.70
10	GENO-10	76.00	37.51	937.84	45.68
11	GENO-11	92.00	47.65	1170.24	56.58
12	GENO-12	98.00	39.05	1391.60	56.84
13	GENO-13	92.00	34.72	1187.72	55.66
14	GENO-14	98.00	36.79	1389.64	60.76
15	GENO-15	76.00	47.21	782.04	36.33
16	GENO-16	84.00	39.06	950.04	41.92
17	GENO-17	76.00	51.43	1075.40	45.07
18	GENO-18	80.00	68.36	1081.60	35.12
19	GENO-19	100.00	24.51	1591.00	56.31
20	GENO-20	92.00	28.53	1269.60	47.66
21	GENO-21	100.00	26.12	1674.00	60.02
22	GENO-22	96.00	28.02	1549.44	62.81
23	GENO-23	100.00	29.34	1696.00	58.70
24	GENO-24	96.00	32.09	1561.92	59.29
25	GENO-25	100.00	32.92	1600.00	61.33
26	GENO-26	100.00	31.57	1610.00	63.27
27	GENO-27	96.00	29.13	1602.24	60.41
28	GENO-28	96.00	38.42	1633.92	62.20
29	GENO-29	96.00	45.10	1452.48	57.88
30	GENO-30	96.00	39.97	1578.24	60.01
31	GENO-31	96.00	37.37	1535.04	59.40
32	GENO-32	100.00	47.09	1747.00	69.57
33	GENO-33	80.00	43.49	1271.20	54.78
34	GENO-34	68.00	54.99	1048.56	28.97
35	GENO-35	100.00	33.05	1590.00	57.40
36	GENO-36	92.00	33.86	1318.36	48.37
37	GENO-37	100.00	33.74	1434.00	60.96
38	GENO-38	100.00	31.77	1518.00	59.63
39	GENO-39	100.00	73.88	1597.00	59.42
40	GENO-40	100.00	41.71	1553.00	57.62
41	GENO-41	96.00	43.56	1490.88	55.20
42	GENO-42	96.00	37.15	1501.44	59.82
43	GENO-43	88.00	44.75	1645.60	55.25
44	GENO-44	96.00	39.84	1514.88	47.32
45	GENO-45	96.00	33.16	1702.08	67.09
46	GENO-46	100.00	31.44	1854.00	65.70
47	GENO-47	100.00	48.71	1678.00	70.71

48	GENO-48	96.00	60.17	1656.00	58.96
49	GENO-49	76.00	88.04	1336.96	40.91
50	GENO-50	96.00	47.41	1492.80	63.30
51	GENO-51	84.00	51.01	1291.08	53.84
52	GENO-52	72.00	83.33	1094.40	34.03
SD±		***8.71***	***13.27***	***235.15***	***8.95***
SE±		***1.21***	***1.84***	***32.61***	***1.24***

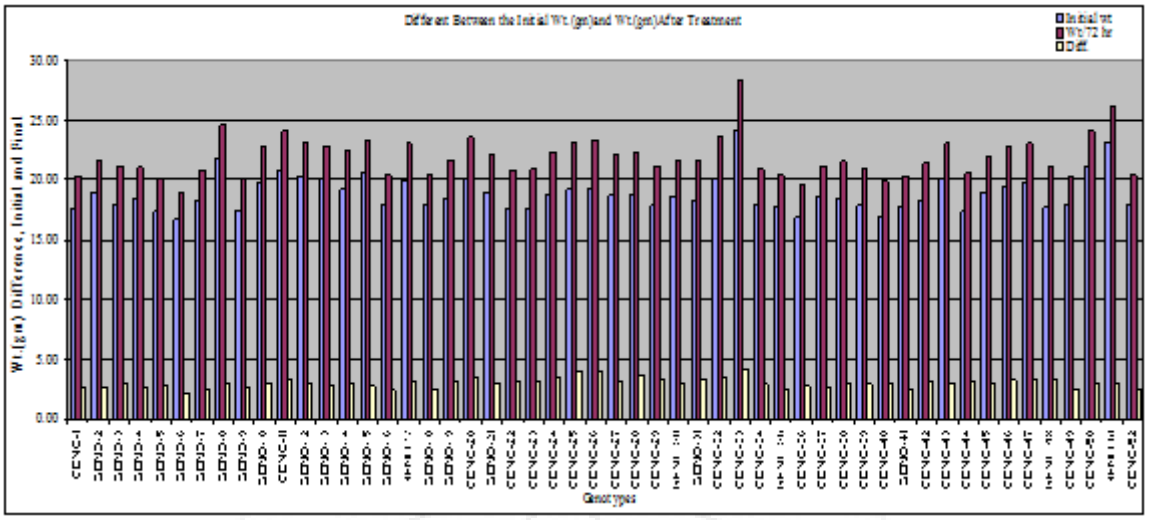

Figure 1: Showing Initial, Final and Difference Wt. (gm) after Treatment

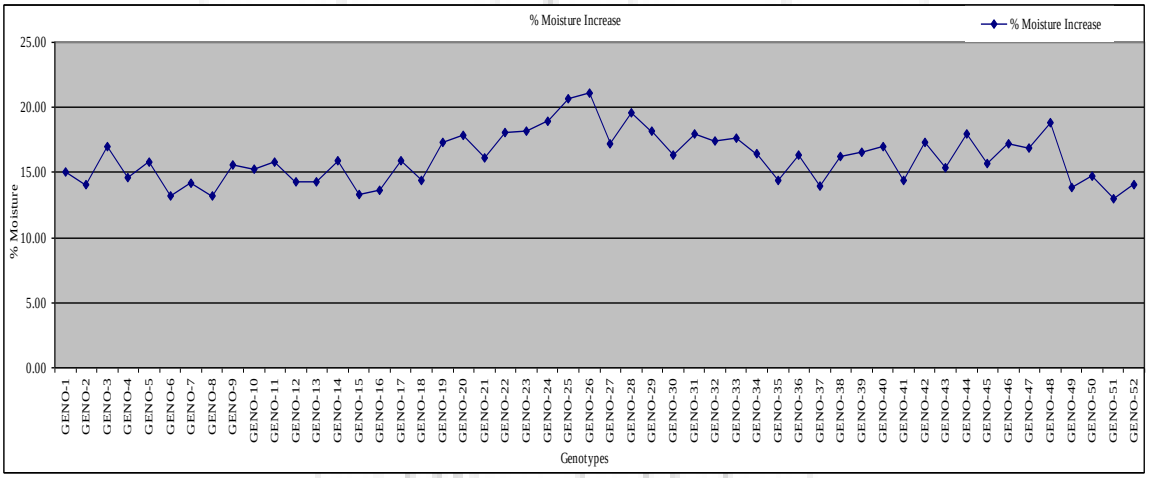

Figure 2: Showing Percent Moisture increase after Treatment

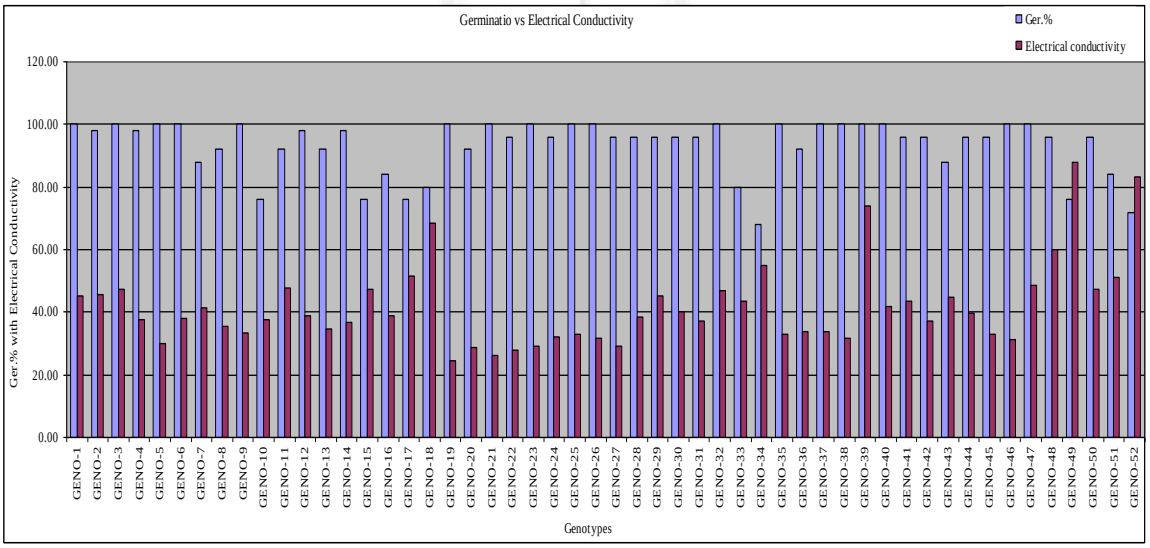

Figure 3: Showing Seed germination and Electrical conductivity

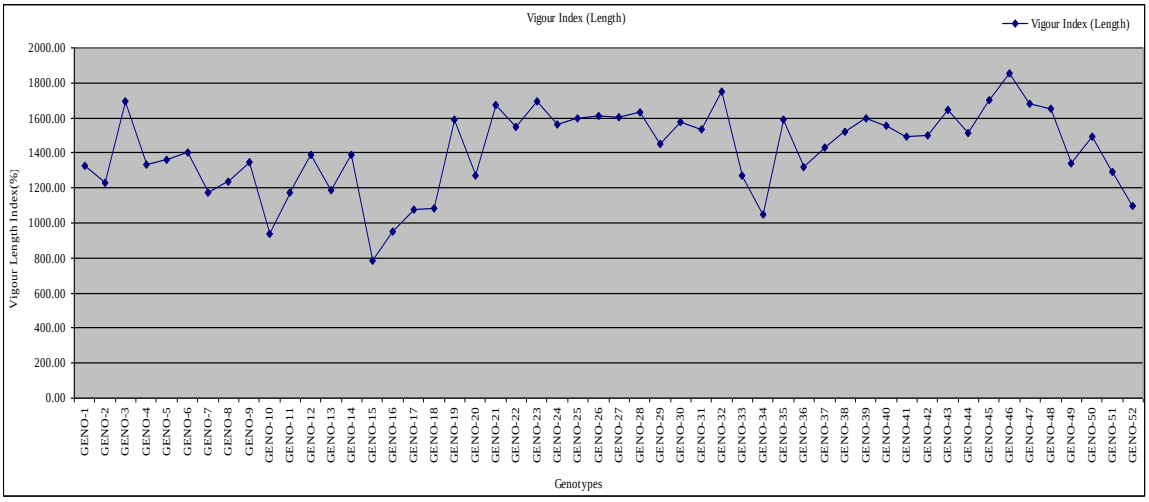

Figure 4: Showing Vigour Index % (Length)

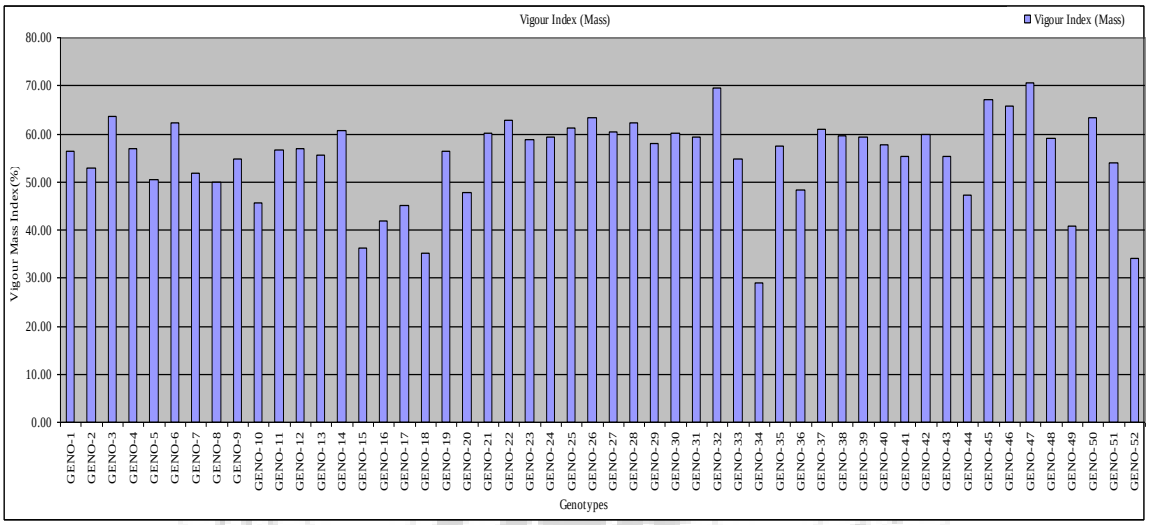

Figure 5: Showing Vigour Index % (Mass)

Soybean genotypes exposed in adverse artificial climatic condition facilitates seeds to deteriorate fast early as normal condition. Fluctuation in all the parameters from gaining moisture to vigour testing parameters, gaining of water moisture different in all genotypes measurable weight(gm) at initial and final after the test period, minimum and maximum changes occurring in weight difference.

Maximum wt. difference high in geno-20 (3.58gm), geno-24, 25, 20, 28, and 33 showed wt. difference 3.54, 3.97, 4.06, 3.65, 4.23gm respectively; minimum difference found in geno-6 (2.21). The geno-33 (4.23gm) reaches maximum point among the geno (Table-1, Fig-1).

% moisture increase maximum in geno- 26(21.11%), minimum in geno-51 (13%), geno-19, 20, 22-29, 31-33, 40, 42, 44, 46, 48 showed % moisture increase 17.33, 17.88, 18.02, 18.21, 18.92, 20.64, 21.11, 17.16, 19.54, 18.15,17.99, 17.39, 17.60, 17.01, 17.37, 17.98, 17.22, 18.87 % respectively; its showed above the 17% (Table-1, Fig-2).

Highest germination percent exactly 100% found in geno-1, 3, 5, 6, 9, 19, 21, 23, 25, 26, 32, 35, 37, 40, 46, 47;minimum germination recorded in geno-34 (68%) (Table-2, Fig-3)

Leachate of nutrients measured by the electrical conductivity meter($\mu scm^{-1}g^{-1}$); less electrical conductivity (below $35\mu scm^{-1}g^{-1}$) found in geno-9, 19-27, 35-38, 46-46 showed, 33.41, 24.51, 28.53, 26.12, 28.02, 29.34, 32.09, 32.92, 31.57, 29.13, 33.05, 33.86, 33.74, 31.77, 33.16, 31.44 $\mu scm^{-1}g^{-1}$ respectively, leachate very low in geno-19 ($24.51\mu scm^{-1}g^{-1}$); higher conductivity found in geno-18, 39, 48, 49, 52 (68.36, 73.88, 60.17, 88.04, $83.33\mu scm^{-1}g^{-1}$ respectively) which is above $60\mu scm^{-1}g^{-1}$ (Table-2, Fig-3)

Vigour index length starting from 782.04(geno-15), 1854.00 (geno-46); geno-19, 21-28, 30-32, 35, 38-40, 42-48, showed vigour index above 1500(1591.00, 1674.60, 1549.44, 1696.00, 1561.92, 1600.00, 1610.00, 1602.24, 1633.92, 1578.24, 1534.04, 1747.00, 1590.00, 1518.00, 1597.00, 1553.00, 1501.44, 1645.60, 1514.88, 1702.08, 1854.00, 1678.00, 1656.00 respectively; highest vigour index length found in geno-46 (1854.00) (Table-2, Fig-4)

Maximum number of geno showed vigour index mass above 50, geno-1-09, 11-14, 19, 21-33, 35, 37-43, 45-48, 50, 51, showed vigour index mass 56.30, 53.02, 63.70, 56.94, 50.40, 62.20, 51.74, 50.05, 54.70, 56.58, 56.84, 55.66, 60.76, 56.31, 60.02, 62.81, 58.70, 59.29, 61.33, 63.27, 61.41, 62.20, 57.88, 60.01, 59.40, 69.57, 54.78, 57.40, 60.96, 59.63, 59.42, 57.62,

55.20, 59.82, 55.25, 67.09, 65.70, 70.71, 58.96, 63.30, 53.84 respectively; highest mass index found in geno-47 (70.71), while minimum found in geno-34 (28.97) (Table-2, Fig-5)

4. Conclusion

Initially moisture gaining by all the genotypes according to transfer of water content from higher concentration body to the lower body and increase in moisture content in seeds as well increase in seed weight (gm), not all the genotypes absorbed the water in same proportion, there is fluctuation in absorbing the water, the seed coat play an important role in absorbing the water and exchange the other gases; the compact and tight seed coat seeds repels the excess of water than those genotypes having loose and flesh seed coat seeds. On basis of accelerated aging testing the good physiological response showed by all the genotypes and it showed the fast deteriorating genotypes by aging test process including the stress tolerant genotypes which will further used as stronger and vigorous genotypes for qualitative parameters, genetic identification and it can be concluded that Accelerated aging it's a great and quick test to identify the stress tolerant and vigour performing genotypes.

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