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Effect of Accelerated Ageing Test on Perfomance of Vegetable Cowpea Genotypes Foliar Spray with Panchagavya

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ABSTRACT

The present study was carried out in three varieties viz., AV-5 (G1), PKB-6 (G2) and PKB-4 (G3) which were foliar sprayed with panchagavya concentration of 0 % (P_0), 2.5 % (P_1), 5 % (P_2) and 7.5 % (P_3) at 30 days DAS for analysing the varietal differences and proper concentration of panchagavya during seed deterioration by subjected them to accelerated ageing at temperature 41±1 ^{0}c and 95 per cent relative humidity for 0 to 10 days. Various physiological and biochemical parameters were explored. It was clearly revealed that irrespective of the treatments, a progressive decline in germination, seedling length and vigour was observed due to ageing However, the EC was continued to increase towards the end of ageing which was negatively correlated with these three phenomena. The decline in germination, seedling length, seedling vigour index and increased electrolytes leakage after 6 days of accelerated ageing clearly suggested that ageing is certain to occur. However, the treatments variations in declaim of seed quality with progressive ageing had also been noticed. Interaction (G_1P_2) genotype AV-5 and panchagavya at 5 % concentration recorded higher seed quality parameters in initial day of ageing test and gradual decrease up to 5 days, later it decreased at higher rate at 10th day of ageing test but per cent decrease was low compared to other treatments. significantly minimum electrical conductivity and seed infection at initial day of ageing test as ageing period increases, increase in these parameters at lower rate up to 5 days after that increase in faster rate were noticed at the end of 10th days, but per cent increase was low in this treatment compared to other treatments.

Key words: *Panchagavya, Genotypes, Humidity, Cowpea*

INTRODUCTION

The name “Cowpea” (*Vign aunguiculata* (L.) Walp) was first used in America and is an important multipurpose arid grain legume referred to as southern pea, black eye pea, lubia, niebe, coupe or frile, extensively cultivated in arid and semiarid regions of Africa and Asia. Cowpea is grown primarily for its cheap source of dietary protein lysine and as a supplemental for meat. It is the native of West Africa.

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But Steele[18] suggested Ethiopia as the primary centre and Africa as secondary center of diversity. India is the largest producer and consumer of pulses in the world accounting for 33 per cent of the world area and 22 per cent of the world production. Cowpea is an important pulse crop of India which occupies an area of 3.9 m ha with a production of 2.2 m t and productivity of 564 kg per hectare. All parts of the plant are used as food for its nutritious, providing protein, vitamins and minerals. Cowpea grain contains an average 55.7 per cent carbohydrates, 24.6 per cent protein, 3.8 per cent iron, 3.2 per cent minerals and it is good source of vitamin B2[7]. Vegetable cowpea is one of important commercial multipurpose pulse crop as it is grown in crop rotation and as intercrop. It is grown mainly as pulse, vegetable, fodder and as in situ manure crop. Vegetable cowpea varieties are early maturing, photo-insensitive, tall and erect or semi erect with long pods held on stalks above the foliage. Vegetable cowpea is most important group and grown in many areas of south and south-west, where as they are preferred over snap beans and lime beans because of their resistance to heat and insects. Vegetable cowpea rich in crude fiber (2.40 g/100g), B-carotene (570 mg/100g) and high in calcium and iron.

Organic and safe food is an emerging issue among the common citizens from the health point of view .the discovery of a new food does more for the happiness of mankind than the discovery of new star. Due to heavy use of enough chemicals from many years soil health and environment spoiled by several chemicals, fertilizers, pesticides, even all food grains, vegetables, fodder etc however, under proposition in our country to meet the demand of increased food production and also to protect the health of environment. Hence it is necessary to utilize organic manures in order to produce healthy and chemical free food products and also to protect environment from heavy use of chemicals under which panchagavya is one of the technique to know the effect of panchagavya on seed yield and quality of cowpea.

The ageing is an universal phenomena occurring in all living organisms during the natural course of development, however, unfavourable/ stress conditions hastens it. Seeds of all plants exhibit a maximum potential for germination immediately after harvest, which declines gradually with an increased storage period. Seed ageing is one of the key factors responsible for the decline in the yield of various food crops. Ageing of seeds is evident through various parameters viz., delayed germination and emergence, slow growth, increased succeptability to environmental stresses[20]. Many process have been suggested as possible mechanisms involved in the seed deterioration like chromosomal damage, loss of activity of various metabolic enzymes, loss of ATP production/storage capacity, deterioration of membranes[15.] Changes in the metabolic activites associated with seed deterioration are highly complex and poorly understood[9]. Accelerated ageing techniques have great potential for understanding the mechanism of ageing and associated deterioration process of seeds. The process of deterioration under accelerated ageing conditions are essentially similar to those under normal conditions, however, the major differences is that the rate of deterioration is much faster, thus, making it possible to study within reasonable time frame. A number of studies have been carried out in past to analyse the physiological and biochemical changes associated with accelerated aged seeds.

MATERIAL AND METHOD

The field experiment was conducted at RIOF, GKVK, UAS, Bengaluru during *kharif* season of 2014-2015.The experiment was laid out in FRCBD with three replications and lab experiment was laid out in FCRD. It comprises of 3 genotypes *viz.,* AV-5, PKB-6, PKB-4 and the foliar application of panchagavya sprayings consist of 0 %, 2.5 %, 5 % and 7.5 % at 30 days after sowing (DAS). The 5 plants from each treatment were selected and tagged for recording growth components like plant height, number of branches, number of effective and ineffective nodules, days to 50 % flowering and days to maturity of plants were recorded at 60 DAS and at harvest then yield components were also recorded and then the seeds collected from each treatment were evaluated for testing seed quality parameters. In order to determine the relative storability of vegetable cowpea seeds from each treatment were subjected for accelerated ageing as per the procedure described by Delouche and Baskin[1]. The required quantity of seeds were subjected to accelerated ageing by incubating at 41±1^{0}c and 95 Per cent relative humidity for 0,1,2,3,4,5,6,7,8,9 and 10 days in single layer on a perforated wire mesh in a thermostatisticaly controlled ageing chamber. The aged seeds were taken out and dried back to their original moisture content and were set out for testing quality parameters.

Statistical analysis

The statistical analysis and the interpretation of the experimental data was done by using Fisher's method of analysis of variance technique as outlined by Gomez and Gomez[3] and the level of significance used in 'F' and 't' test was five per cent.

RESULTS AND DISCUSSION

Deterioration may be indicative of an inability to reform functionally competent membranes during rehydration of seeds resulting in loss of vigour and lack of germination. Delay in the full expression of germination usually the earliest .detectable physiological sign of quality loss in the aged seeds[11]. The delayed expression of full germinability could be used to measure vigour of seed lots of known history. The reduction in physical and physiological activity attributed to irreversible degenerative change accruing in the seeds. According to Parrish and Leopold[12] the loss in vigour was due to decline in early respiratory activity, increased leakage of electrolytes and loss in dry weight from imbibing cotyledon and increase in response of imbibing system in soybean seeds when they were subjected to accelerated ageing.

Genotypes: Table 1 shows that, among the genotypes significant differences were observed for seed quality parameters during accelerated ageing. Irrespective of genotype gradual decrease in seed quality parameters were observed as the ageing period increases. However (G_1) AV-5 recorded higher germination (%), mean seedling length (cm), seedling dry weight (mg), seedling vigour index- I and seedling vigour index- II compared to other genotypes. Initially it has recorded higher germination (83.39 %), mean seedling length (32.60 cm), seedling dry weight (58.28 g), seedling vigour index- I (1516) and seedling vigour index- II (2684). At the end of 10th day of accelerated ageing, it has maintained higher germination (3.85 %), mean seedling length (6.49 cm), seedling dry weight (6.81 g), seedling vigour index-I (25) and seedling vigour index-II (26) as compared to other genotypes. This may be due to genetic background of that genotype. Other seed quality parameters like electrical conductivity and seed infection were found to be differed significantly among the genotypes. The genotype (G_1) AV-5 showed minimum electrical conductivity and seed infection for initial days (0.061 dSm^{-1} and 22.92 %, respectively) as ageing period increases gradual increase in these parameters were noticed at the end of 10th day (0.067 dSm^{-1} and 86.05 %, respectively) but lower increase compared to other genotypes.

Table 1: Influence of vegetable cowpea genotypes (G) and panchagavya spray (P) on seed quality parameters after accelerated ageing test.

	Germination (%)				Mean seedling length (cm)				Seedling dry weight (mg)				Seedling vigour index-I			
	A_4	A_5	A_6	Mean	A_4	A_5	A_6	Mean	A_4	A_5	A_6	Mean	A_4	A_5	A_6	Mean
Genotypes																
G_1	80.88	78.99	69.54	**62.69**	31.74	31.09	24.37	**24.19**	57.24	56.27	47.39	**42.81**	2587.42	2476.88	1728.16	**1789.39**
G_2	76.89	75.09	65.62	**58.79**	29.38	28.73	21.13	**21.60**	53.01	51.86	42.79	**38.43**	2275.81	2180.47	1426.95	**1531.48**
G_3	79.01	75.63	66.91	**60.34**	30.11	29.52	22.93	**22.71**	54.92	53.23	45.43	**40.61**	2394.76	2251.84	1564.14	**1627.70**
S.Em±	0.23	0.22	0.16		0.26	0.31	0.22		0.21	0.16	0.22		15.36	22.56	14.71	
CD (P=0.05)	0.68	0.64	0.48		0.75	0.90	0.63		0.63	0.48	0.64		44.83	65.85	42.94	
Panchagavya sprayings																
P_0	73.23	69.07	59.69	**54.40**	25.70	25.17	14.02	**16.78**	49.29	48.28	35.12	**32.88**	1884.23	1740.65	839.27	**1166.76**
P_1	76.35	74.58	65.73	**58.35**	28.87	27.92	19.65	**20.66**	50.94	49.66	43.02	**36.92**	2204.45	2083.52	1295.37	**1445.83**
P_2	85.73	84.25	73.67	**67.36**	36.35	35.87	31.99	**29.56**	64.89	64.05	54.35	**50.42**	3118.42	3023.89	2357.50	**2252.18**
P_3	80.39	78.39	70.32	**62.32**	30.72	30.16	25.59	**24.34**	55.11	53.15	48.32	**42.25**	2470.21	2364.20	1800.19	**1733.31**

S.Em±	0.27	0.25	0.19		0.30	0.36	0.25		0.25	0.19	0.25		17.74	26.05	16.99	
CD (P=0.05)	0.79	0.74	0.55		0.86	1.04	0.73		0.72	0.55	0.74		51.77	76.04	49.58	
Genotypes X Panchagavya sprayings																
G_1P_0	74.98	71.65	61.43	**56.07**	27.48	26.87	15.43	**18.30**	49.87	48.54	37.83	**33.92**	2060.03	1925.10	947.89	**1284.97**
G_1P_1	78.45	77.23	68.98	**60.35**	29.28	28.67	21.53	**21.86**	52.41	51.02	45.65	**39.07**	2296.78	2214.18	1485.01	**1553.92**
G_1P_2	88.43	86.43	75.87	**70.49**	38.56	37.87	32.76	**31.07**	69.34	68.86	55.65	**53.66**	3409.15	3272.23	2485.25	**2475.80**
G_1P_3	81.65	80.65	71.87	**63.86**	31.65	30.95	27.75	**25.53**	57.35	56.65	50.43	**44.59**	2583.72	2496.01	1994.47	**1842.85**
G_2P_0	70.66	66.88	57.67	**52.41**	24.27	23.76	11.76	**15.17**	48.96	47.76	31.76	**31.69**	1714.89	1589.23	678.05	**1039.19**
G_2P_1	75.25	72.87	62.45	**56.95**	28.57	27.43	17.76	**19.45**	49.96	48.65	39.86	**34.89**	2149.24	1998.62	1108.89	**1361.01**
G_2P_2	83.00	82.86	71.89	**64.81**	35.22	34.87	31.56	**28.71**	60.35	59.65	52.76	**47.19**	2922.29	2889.99	2269.25	**2107.52**
G_2P_3	78.65	77.76	70.45	**60.99**	29.46	28.87	23.45	**23.08**	52.76	51.38	46.76	**39.96**	2316.81	2244.03	1651.62	**1618.21**
G_3P_0	74.06	68.67	59.98	**54.70**	25.36	24.87	14.87	**16.87**	49.03	48.54	35.76	**33.02**	1877.78	1707.62	891.88	**1176.12**
G_3P_1	75.36	73.65	65.76	**57.77**	28.76	27.67	19.65	**20.66**	50.45	49.32	43.56	**36.79**	2167.32	2037.75	1292.22	**1422.56**
G_3P_2	85.76	83.45	73.24	**66.77**	35.26	34.87	31.65	**28.90**	64.98	63.64	54.65	**50.41**	3023.83	2909.43	2318.00	**2173.22**
G_3P_3	80.87	76.76	68.65	**62.12**	31.04	30.65	25.56	**24.39**	55.23	51.42	47.76	**42.20**	2510.10	2352.56	1754.47	**1738.88**
S.Em±	0.47	0.44	0.33		0.51	0.62	0.43		0.43	0.33	0.44		30.72	45.13	29.42	
CD (P=0.05)	1.36	1.29	0.96		1.49	1.81	1.27		1.25	0.96	1.29		89.66	131.71	85.87	
CV (%)	**1.03**	**1.00**	**0.84**		**2.92**	**3.60**	**3.29**		**1.35**	**1.06**	**1.69**		**2.20**	**3.39**	**3.24**	

Table 1 cont.............

	Total dehydrogenase activity (OD Value)				**Electrical conductivity (dSm^{-1})**				**Seed infection (%)**				**Field emergence (%)**			
	A_4	**A_5**	**A_6**	**Mean**	**A_4**	**A_5**	**A_6**	**Mean**	**A_4**	**A_5**	**A_6**	**Mean**	**A_4**	**A_5**	**A_6**	**Mean**
Genotypes																
G_1	2.76	2.59	2.43	**2.31**	0.06	0.07	0.07	**0.07**	28.09	31.04	53.12	**46.53**	78.57	72.07	60.30	**53.61**
G_2	2.23	2.14	1.93	**1.88**	0.07	0.08	0.08	**0.08**	36.99	40.60	57.85	**52.87**	75.07	69.07	58.19	**51.02**
G_3	2.41	2.06	2.11	**2.03**	0.07	0.07	0.08	**0.08**	34.77	37.29	55.73	**50.50**	78.04	70.79	59.55	**52.35**
S.Em±	0.05	0.04	0.03		0.00	0.00	0.00		0.31	0.26	0.23		0.31	0.26	0.23	
CD (P=0.05)	0.15	0.11	0.10		0.00	0.00	0.00		0.90	0.75	0.67		0.90	0.75	0.67	
Panchagavya sprayings																
P_0	1.36	1.37	1.22	**1.19**	0.08	0.08	0.09	**0.08**	50.24	53.54	66.20	**62.76**	71.35	63.85	53.70	**46.55**
P_1	2.18	2.07	1.93	**1.81**	0.08	0.08	0.08	**0.08**	40.00	42.51	60.80	**55.65**	76.57	68.92	57.34	**50.63**
P_2	3.53	2.94	2.97	**2.98**	0.05	0.05	0.06	**0.06**	15.80	19.69	43.14	**36.16**	82.53	77.43	66.18	**58.19**
P_3	2.80	2.67	2.50	**2.32**	0.07	0.07	0.08	**0.07**	27.09	29.50	52.12	**45.29**	78.45	72.38	60.17	**53.93**
S.Em±	0.06	0.04	0.04		0.00	0.00	0.00		0.36	0.30	0.27		0.36	0.30	0.27	
CD (P=0.05)	0.17	0.12	0.12		0.00	0.00	0.00		1.04	0.86	0.77		1.04	0.86	0.77	
Genotypes X Panchagavya sprayings																
G_1P_0	1.74	1.73	1.72	**1.50**	0.08	0.08	0.08	**0.08**	42.98	46.87	64.76	**59.58**	75.04	65.67	54.87	**48.28**
G_1P_1	2.40	2.30	2.10	**2.01**	0.08	0.08	0.08	**0.08**	36.65	37.87	58.87	**52.65**	77.07	70.23	58.03	**51.80**
G_1P_2	3.90	3.53	3.30	**3.25**	0.04	0.05	0.05	**0.05**	9.87	13.54	39.98	**32.14**	83.48	78.76	67.33	**59.67**
G_1P_3	3.00	2.80	2.60	**2.49**	0.06	0.06	0.07	**0.07**	22.87	25.86	48.87	**41.74**	78.67	73.63	60.98	**54.70**
G_2P_0	1.02	1.05	0.61	**0.87**	0.08	0.08	0.09	**0.09**	53.98	57.98	67.98	**64.98**	64.67	61.09	52.56	**44.30**
G_2P_1	2.03	1.90	1.80	**1.66**	0.08	0.08	0.08	**0.08**	42.56	45.78	62.66	**58.18**	75.76	67.65	56.00	**49.65**
G_2P_2	3.30	3.10	2.90	**2.81**	0.06	0.06	0.07	**0.07**	19.76	23.76	45.87	**39.35**	81.83	75.76	65.33	**56.91**
G_2P_3	2.57	2.50	2.40	**2.17**	0.08	0.08	0.08	**0.08**	31.65	34.87	54.87	**48.97**	78.01	71.76	58.87	**53.22**
G_3P_0	1.31	1.33	1.32	**1.20**	0.08	0.08	0.08	**0.08**	53.76	55.76	65.87	**63.71**	74.33	64.78	53.67	**47.07**
G_3P_1	2.10	2.00	1.90	**1.75**	0.08	0.08	0.08	**0.08**	40.78	43.87	60.87	**56.12**	76.87	68.87	57.98	**50.45**
G_3P_2	3.40	2.20	2.70	**2.88**	0.06	0.06	0.07	**0.06**	17.76	21.76	43.56	**37.00**	82.27	77.76	65.87	**57.99**
G_3P_3	2.82	2.70	2.50	**2.31**	0.06	0.08	0.08	**0.07**	26.76	27.76	52.63	**45.16**	78.67	71.76	60.67	**53.87**
S.Em±	0.10	0.07	0.07		0.00	0.00	0.00		0.62	0.51	0.46		0.62	0.51	0.46	
CD (P=0.05)	0.30	0.21	0.20		0.00	0.00	0.00		1.81	1.49	1.34		1.81	1.49	1.34	
CV (%)	**4.51**	**4.54**		**0.11**	**0.11**	**0.11**		**3.22**	**2.44**	**1.43**		**1.39**	**1.25**	**1.34**		

Accelerated ageing test done for 1 to 10 days, but here mentioned variation days at 4^{th}, 5^{th} and 6^{th} days and mean of whole 10 days mentioned

With the advancement of ageing period total dehydrogenase activity and field emergence found significantly higher in initial days of accelerated ageing in (G_1) AV-5 (2.90 OD value and 81.09 % respectively). As ageing period increases there is decrease in these parameters at 10^{th} day (0.93 OD value and 1.00 % respectively) but per cent decrease was highest in other genotypes.

Deterioration may be indicative of an inability to reform functionally competent membranes during rehydration of seeds resulting in loss of vigour and lack of germination. Similar conclusions were drawn on growth efficiency and seedling vigour as a result of ageing effects with regard to genotype responses were also reported by several workers[2,4,6,10,19].

Panchagavya spray: Table 1 shows that**,** among different levels of panchagavya spray, a significant difference was observed for seed quality parameters during accelerated ageing. Irrespective of concentrations, gradual decreases in seed quality parameters were observed as the ageing period increases. However, (P_2) panchagavya at 5 % recorded higher germination (%), mean seedling length (cm), seedling dry weight (mg), seedling vigour index- I and seedling vigour index- II compared to other genotypes. Initially it has recorded higher germination (88.88 %), mean seedling length (37.35 cm), seedling dry weight (65.63 g), seedling vigour index- I (1991) and seedling vigour index-II (3782). At the end of 10th day of accelerated ageing, it has maintained higher germination (6.75 %), mean seedling length (9.52 cm), seedling dry weight (13.09 g), seedling vigour index- I (64) and seedling vigour index- II (88) as compared to other treatments.

Other seed quality parameters like electrical conductivity and seed infection were found to be differed significantly among the concentrations, the panchagavya spray at 5 % (P_2) showed minimum electrical conductivity and seed infection for initial days (0.052 dSm^{-1} and 10.89 %, respectively) and as ageing period increases gradual increase in these parameters were noticed at the end of 10th days (0.079 dSm^{-1} and 81.80 %, respectively) but per cent increase was low in this treatment compared to other treatments. Similar observations were made by Maraddi[8] in cowpea. Patil *et al*.[13] in chickpea and Sharma *et al*.[17] in soybean.

With the advancement of ageing period, total dehydrogenase activity (OD value) and field emergence (%) found significantly higher in initial days of accelerated ageing in (P_2) panchagavya spray at 5 % concentration (3.81 OD value and 84.67 % respectively) and as ageing period increases there is decrease in these parameters at 10th day (1.08 OD value and 2.33 % respectively) but per cent decrease was highest in other treatments. The marked decrease in the seed quality parameters under advancing storage period may be attributed to seed coat characters[1] age induced physicochemical seed deterioration, lipid peroxidation leading to production of toxic metabolites that act upon cell and cell organelles denaturation of proteins and enzymes[16]. Similar decline in seed quality parameters with advancing storage period were also reported by Pramila[14] in blackgram.

Genotypes × panchagavya spray: Table 1 shows that, influence of genotype and panchagavya interaction showed significant difference for seed quality parameters during accelerated ageing. The (G_1P_2) *i.e.*, genotype AV-5 and panchagavya at 5 % recorded higher seed quality parameters in initial day of ageing test *i.e.*, germination (93.63 %), mean seedling length (39.53 cm), seedling dry weight (70.20 g), seedling vigour index- I (3701),seedling vigour index- II (6573) and gradual decrease up to 5 days, later it decreased at higher rate and reached germination (7.54 %), mean seedling length (9.77 cm), seedling dry weight (15.75 g), seedling vigour index- I (74),seedling vigour index- II (119) at 10th day of ageing test but per cent decrease was low compared to other treatments.

The influence of (G_1P_2) genotype AV-5 and panchagavya at 5 % for other seed quality parameters showed significantly minimum electrical conductivity and seed infection at initial day of ageing test (0.043 dSm^{-1} and 7.33 % respectively). As ageing period advanced, increase in these parameters was noticed at lower rate up to 5 days, after that increase in faster rate were noticed at the end of 10th days (0.078 dSm^{-1} and 80.87 %, respectively) but per cent increase was low in this treatment compared to other treatments.

With the advancement of ageing period total dehydrogenase activity (4.03 OD value) and field emergence (85.67 %) found significantly higher in initial days of accelerated ageing in (G_1P_2) genotype AV-5 and panchagavya at 5 % (4.03 OD value and 85.67 % respectively). As ageing period increased, there was decrease in these parameters at 10th day (1.15 OD value and 4 % respectively) but per cent decrease was highest in other treatments.

Graphical representation of seed quality parameters after accelerated ageing test

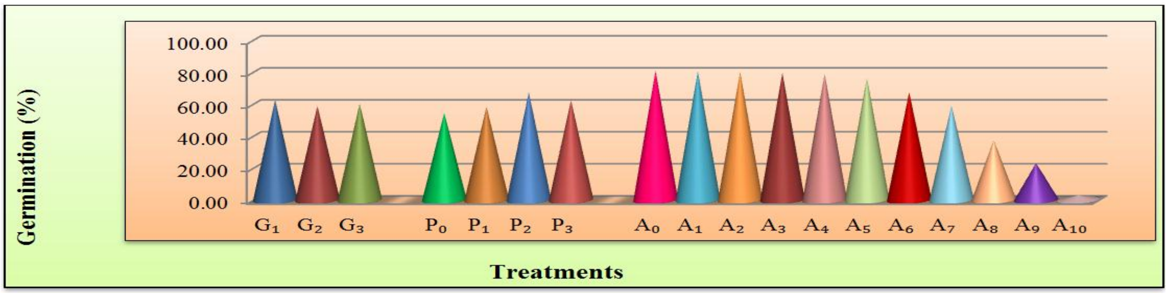

Fig. 1: Influence of genotypes and panchagavya spraying on germination (%) after accelerated ageing test

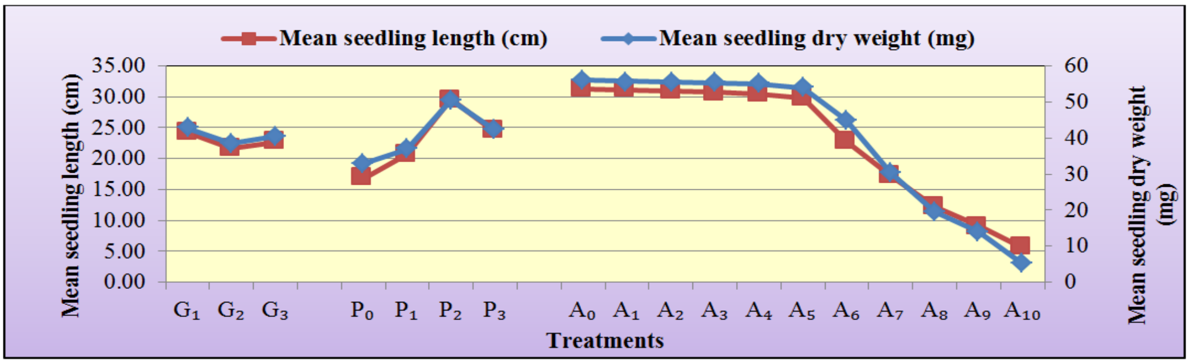

Fig. 2: Influence of genotypes and panchagavya spraying on mean seedling length and mean seedling dry weight after accelerated ageing test

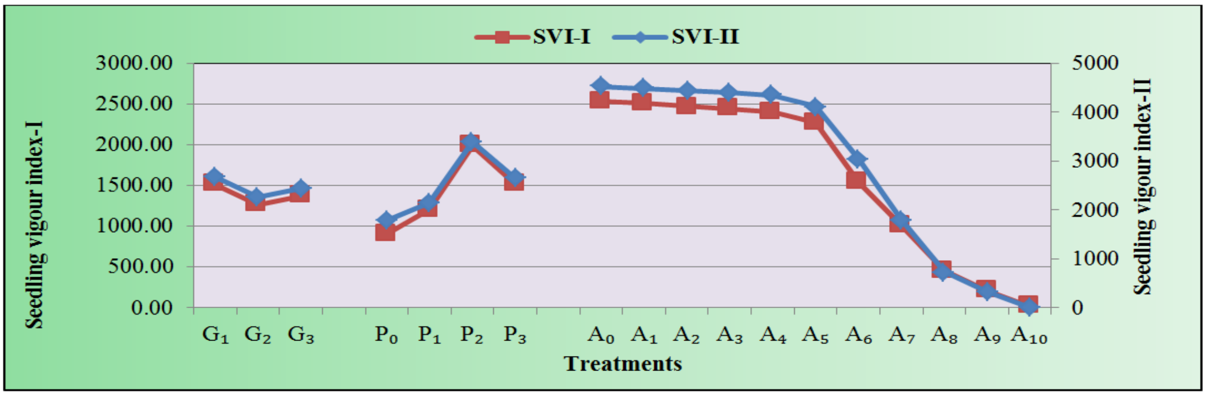

Fig. 3: Influence of genotypes and panchagavya spraying on seedling vigour index (SVI)-I and II after accelerated ageing test

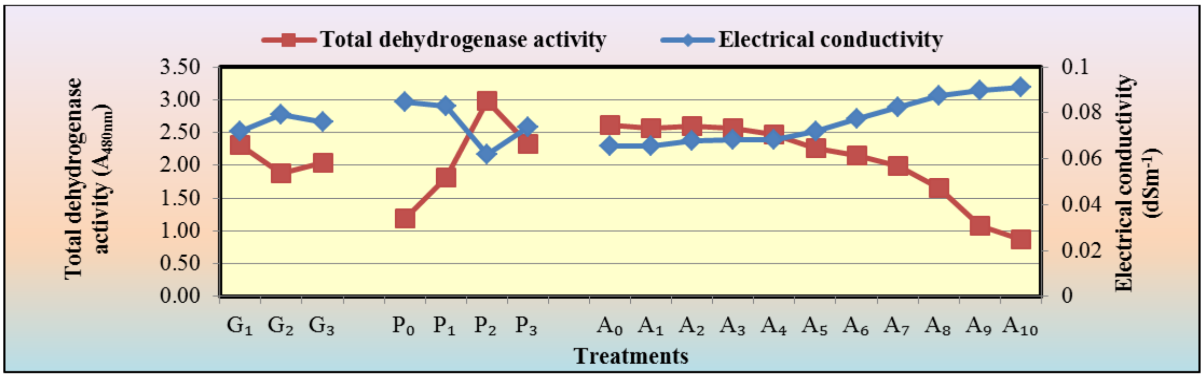

Fig. 4: Influence of genotypes and panchagavya spraying on total dehydrogenase (TDH) activity and electrical conductivity after accelerated ageing test

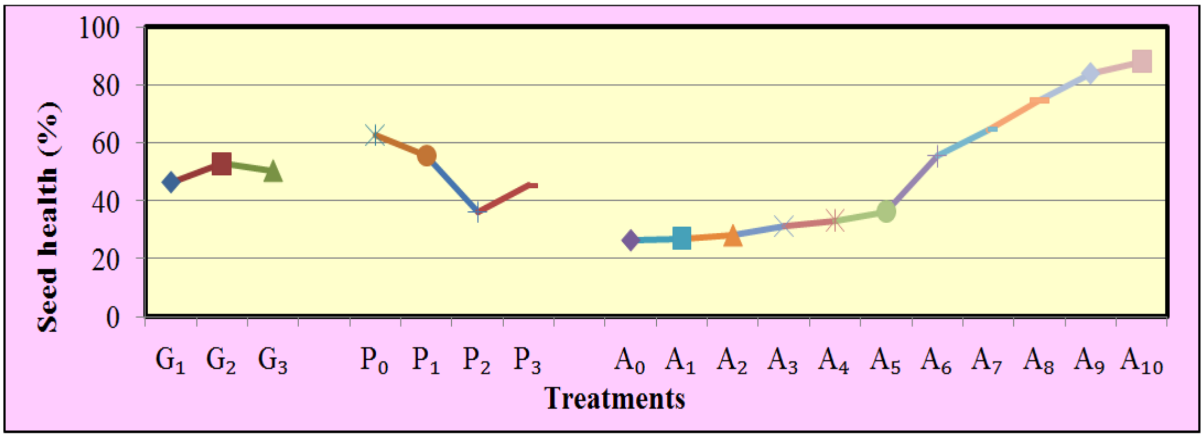

Fig. 5: Influence of genotypes and panchagavya spraying on seed health after accelerated ageing test

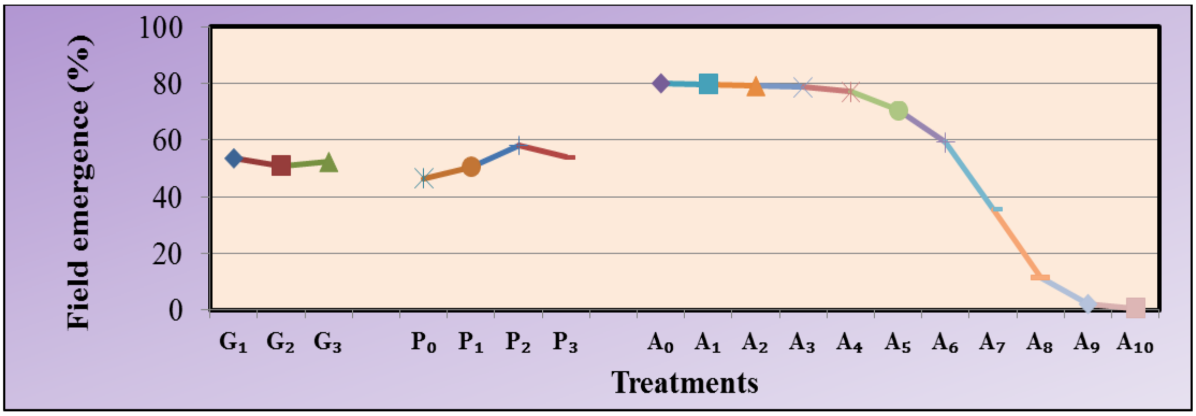

Fig. 6: Influence of genotypes and panchagavya spraying on field emergence (%) after accelerated ageing test.

CONCLUSION

At the end of accelerated ageing test, genotype AV-5 had shown least reduction of seed quality attributes compared to other 2 genotypes, and panchagayva spraying at concentration of 5 % also shown least reduction in seed quality attributing characters. So it is conclude that combination of genotype AV-5+ Panchagavya spray at 5 % concentration performed best at both field and as well lab storage conditions.

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