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Short communication

Effect of seed aging and hormonal priming on different physiological attributes in french bean

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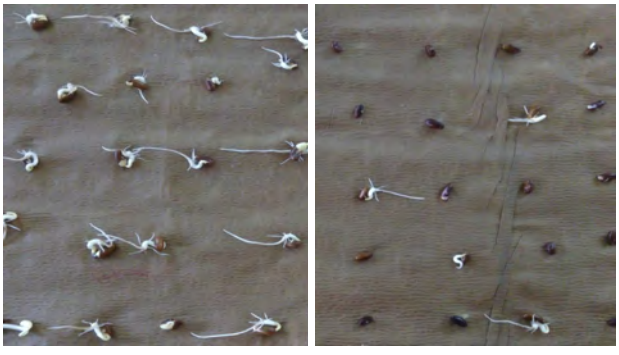
ABSTRACT

Use of aged seed is one of the main factors in athining lower plant yield loss. If proper seed storage facilities are not available it increases the process of seed viability and vigour loss. To assess the effects of aging on seed vigour and viability a laboratory experiment was initated by artifically ageing the seed at high temperature (45^{0}C) and high RH (in 100%). Also, the efficiency of priming treatment was tested in improving the quality of acculated aged seeds of French bean. Our result showed that seed priming treatments significantly (pd" 0.01) affected germination percentage and other growth parameters. Seed priming with 5ppm GA3 was found beneficial in improving seed germination in accelerated aged seeds of French bean. Priming with IAA and kinetin was not found effective in improving germination and other growth parameters in aged seeds of French bean.

Key words: GA_3, Growth hormones, IAA, Accelerated aging, NAA, Priming, Germination, Seed viability, Seed vigour

Seed is an important input in agricultural production and its quality is essential in determining maximum potential crop yield. Conditions under which the seeds are stored is often a major cause of poor seed quality. French bean is a very important crop which is used as vegetable and pulses both. Seeds of French bean are very sensitive to aging. Seeds deteriorate very rapidly if they are not stored at places with proper control of humidity and temperature. Temperature and relative humidity are the main factors influencing seed deterioration and viability loss in storage (Barton, 1964; James, 1967; Roberts, 1972). Seed ageing is generally marked by reduction in vigor (Trawatha *et al*. 1995, Gupta and Aneja 2004), viability, rate and capacity of germination (Chhetri *et al.* 1993, Arefi and Abdi, 2003) increased solute leakage (Kalpana and Rao1995, Basra *et al*. 2003). In laboratory, to assess the effect of aging, accelerated aging test is done. The accelerated aging test is acknowledged as one of the most employed tests to evaluate the physiological potential of various species of seeds, providing information of high degree of consistency (TeKrony, 1995). The principle of the method is based on the artificial acceleration of the deterioration rate of the seeds, by exposing them to high temperature and relative humidity levels, which are considered as the most prominent environmental factors with respect to the intensity and velocity of deterioration (Marcos Filho, 1999). Effects of seed aging have been studied in French bean (Pandey 1989, Komba *et al*. 2006), but we do not found any published data on the improvement of seed vigour in accelerated aged seeds in french bean. Seed deterioration is a serious problem in developing countries where is the scarcity of proper seed storage facilities. Knowing that seed aging and deterioration can affect the seed vigour, the present study aim to analyse the effect of priming with different hormones and their concentrations on the germination and various growth parameters in accelerated aged seeds of French bean.

French bean seeds of variety Pant Anupam were used for the experiment. Moisture content of the seed was 12 %. Seeds were disinfected with the 1% sodium hypochlorite solution and dried. Then the seeds were kept in desiccators and placed in an oven at 45^{0}C temperature and 100% relative humidity for seven days. During this period germination test was done after 2nd, 4th and 6th day to analyse the reduction in germination percentage and we found 75% and 50%, 30% reduction in germination respectively during the accelerated aging experiment (Fig-1).



(B)

Fig.1 Effect of accelerated aging on seed germination of Franch bean seeds were kept at 45^{0}C temperature and 100 % relative humidity for one week for accelerated aging. Germination after one week of accelerated aging was 28 %.

The aged seeds of French bean were then treated with growth regulators. Seed moisture content after aging was increased to 20%. Before priming treatment seeds were

again dried to the 12% moisture content. Three different concentrations (5 ppm, 10 ppm and 15 ppm) of IAA, Kinetin and GA_3 were used for seed priming. Seeds were soaked for 4 hrs in the different concentrations of growth hormones at 25^0C temperature. Then seeds were dried and these primed seeds were used for further experiment.

Primed seeds were germinated between moistened towel papers, according to ISTA (2006) rules. Three replications of thirty seeds each were used for different treatments. The towel papers moistened with water and kept in germinator at 25^0C for fifteen days. Experimental design used for the experiment was CRD. During this period data for different growth parameters was taken.

Observations on germination percentage, speed of germination, root length, shoot length, fresh weight, and dry weight were recorded and seedling vigour I and II were calculated. Seedling vigour I and II were calculated by using the following formula Seedling vigour index 1: Seedling length × Germination %, Seedling vigour index 2: Seedling dry weight × Germination %. The data was statistically analysed using ANOVA to calculate the magnitude of F value.

Seed priming in aged seeds of French bean significantly affect the germination and other growth parameter (Table-1). Germination was reduced to 28.33 % after accelerated aging (Fig -1).Seed deterioration during aging has been associated with a sequence of chromosome aberrations and damage to DNA, changes in RNA and protein synthesis, changes in enzyme and reserve substances, loss in respiratory activity and ATP production, membrane changes and eventually cell destruction which is displayed by failure of the seed to germinate (Smith and Berjak, 1995).

Failure of aged seeds to germinate might be due to lipid peroxidation, mitochondrial dysfunction and less ATP production (Basra *et al*. 2003).

When the accelerated aged seeds of French bean were primed with GA_3 5ppm, an improvement in seeds germination and other growth parameters was observed

(A) (B) (C) (D)

Fig. 2. Effect of GA_3 priming on seedling growth of accelerated aged seeds of French bean.
(A- Accelerated aged seeds without priming, B- Seed priming with 5 ppm GA_3, C- Seed priming with10 ppm GA_3, D- Seed priming with 15 ppm GA_3)

(Table-1, Fig-2). When the seeds were primed with GA_3 (5 ppm) germination percentage was 55 % followed by GA_3 (10 ppm) (31.67 %). Aged seeds primed with GA_3 (5 ppm) showed an improvement of 94% in germination over control (Table-1). Priming with GA_3 also found to increase the GA_3 germination percentage and antioxidant activity in sorghum seeds. Maximum seedling length was found in the treatment with GA_3 (5 ppm) that was 21.39 cm followed by GA_3 (15 ppm) (17.88 cm).

Maximum fresh weight, dry weight, seedling vigour index-1 and seedling vigour index-2 were recorded in treatment with GA_3 (5 ppm) that were 10.68 gm, 1.01 gm, 1176.45 and 56.21 respectively (Table-1). Due to reduction in antioxidant activity germination percentage and other growth parameters were increased (Azadi *et al*. 2013). Higher concentration of GA_3 (15 ppm) found to reduce germination and other growth parameters. Germination percentage was decreased with increase in the concentration of GA_3. The study was supported by Chauhan *et al*. (2009) who found the reducing effect of higher concentration of GA_3 on germination and growth in horse gram and black gram.

Reduction in germination percentage and other growth parameters was found in the seeds primed with the various concentrations (5 ppm, 10ppm and 15 ppm) of IAA and Kinetin (Table -1). Minimum germination percentage

Table 1. Effect of hormonal priming on different physiological parameters in aged seeds of French bean.

Treatments	Germination (%)	Speed of germination	Seedling length (cm)	Fresh weight (g)	Dry weight (g)	Vigour index-1	Vigour index 2
IAA (5 PPM)	11.66	0.32	8.04	4.10	0.14	94.97	1.63
IAA (10 PPM)	10.00	0.18	5.12	1.76	0.33	35.58	0.48
IAA(15 PPM)	10.00	0.26	10.58	3.62	0.28	107.50	3.00
Kinetin (5PPM)	13.33	0.37	13.22	1.21	0.22	173.56	2.90
Kinetin (10PPM)	10.00	0.29	11.15	3.06	0.30	112.25	3.10
Kinetin (15PPM)	13.33	0.37	14.02	4.11	0.26	187.00	3.36
GA_3 (5PPM)	**55.00**	**1.57**	**21.39**	**10.68**	**1.01**	**1176.45**	**56.21**
GA_3 (10PPM)	31.67	0.81	15.41	7.62	0.86	490.70	27.91
GA_3 (15PPM)	20.00	0.58	17.88	5.85	0.49	353.93	9.30
Control	28.33	0.80	17.73	4.41	0.20	503.75	5.78
CD 1%	7.79	0.20	1.04	0.64	0.80	139.54	6.92

(10%) was recorded when the aged seeds of French bean were primed with IAA (10 and 15 ppm) and Kinetin (10 and 15 ppm) respectively. Hadley (1970) found that1–10 ppm of Kinetin with or without the IAA can in hibitseed germination in *Dactylorhiza purpurella*. Chaudhary *et al.* (2012) also found the reducing effect of IAA and kinetin on seed germination, seedling length and fresh weight of *Dianthus caryophyllus*.

GA_3 was more effective for seed germination than Kinetin and IAA, which was in accordance with Chakrabarti and Mukherji (2003). The role of GA_3 in overcoming the harmful effects on growth may be due to the change in the endogenous growth regulators (Izumiand 1996). It has been confirmed that exogenous application of GA_3 promotes seed germination of many plants (Taiz and Zeiger 2010).

From above findings it can be concluded that accelerated aging reduces germination in French bean seeds. When these aged seeds were primed with GA_3 (5 ppm), there was an improvement in germination and other growth parameters. While priming of these aged seeds with IAA and Kinetin showed a reduction in germination and other growth parameters.

REFERENCES

Arefi HM and Abdi N. 2003. Study of variation and seed deterioration of *Festucaovina* germplasm in natural resources genebank. Iranian Journal of Rangelands and Forests Plant Breeding and General Research **11:** 105-125.

Azadi MS, Tabatabaei SA, Younesi E, Rostam MR and Mombeni M. 2013. Hormone priming improves germination characteristics and enzyme activity of sorghum seeds (*Sorghum bicolor* l.) under accelerated aging. Cerc Agronomyîn Moldova **3:** 49-55.

Barton LV. 1964. Seed Preservation and longevity. Inter-social publishers, Inc. New York, pp. 138-157.

Basra SMA, Ahmad N, Khan MM, Iqbal N and Cheema MA. 2003. Assessment of cottonseed deterioration during accelerated ageing. Seed Science and Technology **31:** 531-540.

Chakrabarti N and Mukherji S. 2003. Effect of Phytohormone pretreatment on nitrogen metabolism in *Vigna radiata* under salt stress. Biology of Plant **46:** 63-66.

Chauhan JS, TomarYK, Indrakumar SN, Seema A and Mukharjee D. 2009. Effect of growth hormones on seed germination and seedling growth of black gram and horse gram. Journal of American Science **5:** 79-84.

Chhetri DR, Rai AS and Bhattacharjee A. 1993. Chemical manipulation of seed longevity of crop species in an unfavorable storage environment. Seed Science and Technology **21:** 31-44.

Chowdhury R, Mamgain A, Ray S and Tah J. 2012. Effect of gibberellic acid, kinetin and indole 3 acetic acid on seed germination performance of *Dianthus caryophyllus* (Carnation). Agriculturae Conspectus Scientificus **77:** 157-160.

Gupta A and Aneja KR. 2004. Seed deterioration in soybean varieties during storage- physiological attributes. Seed Research. **32:** 26-32.

International Seed Testing Association. 2006. ISTA Handbook on Seedling Evaluation. Switzerland.

James E. 1967. Preservation and seed stocks. Advances in Agronomy **19:** 87-106.

Kalpana R and Rao MKV. 1995. On the ageing mechanism in pigeonpea (*Cajanus Cajan* L. Millsp) seeds. Seed Science and Technology **23:** 1-9.

Komba CG, Burton BJ and Hamptton JG. 2006. Ageing of French bean seeds at ambient temperature in relation to pumpkin and zucchini seeds. Seed Science and Technology **34:** 209-214.

Marcos F and TestesDe VJ. 1999. Importância E Utilização. In: Krzyzanowski. FC. Vieira, RD, França N. J.B. (Ed.) Vigor De Sementes: Conceitos E Testes. Londrina: Abrates, Cap.1 pp.1-21.

Pandey DK. 1989. Ageing of frenchbean seeds at ambient temperature in relation to vigour and viability. Seed Science and Technology **10:** 81-102.

Roberts EH. 1972. Storage environment and control of viability, cytological, genetical and metabolic changes associated with loss of viability. Inc: Viability of seeds. Roberts, E.H., (ed.) Chapman and Hall, London.

Smith MT and Berjak P. 1995. Deteriorative changes associated with the loss of viability of stored dessication-tolerant and dessication-sensitive seeds. Rome, Italy. Pp. 701-746.

Taiz L. and Zeiger E. 2010. Plant Physiology. Sinauer Associates Inc., USA,.

Tekrony DM. 1995. Accelerated aging. In: van de venter, H.A. (Ed.) Seed vigour testing seminar. Copenhagen: ISTA. Pp. 53-72.

Trawatha SE, Tekrony DM and Hidebrand DF. 1995. Relationship of soybean seed quality to fatty acid and C -Aldehyde levels during storage. Crop Science **35:** 1415-1422.